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LIFT TESTS OF A 0.1536c THICK DOUGLAS AIRFOIL SECTION OF

NACA 7-SERIES TYPE EQUIPPED WITH A LATERAL-CONTROL

DEVICE FOR USE WITH A FULL-SPAN DOUBLE-SLOTTED

FLAP ON THE C-74 AIRPLANE

By Robert J. Nuber and Fred J. Rice, Jr.

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NACA

WASHINGTON

MR No. L5C24a

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

MEMORANDUM REPORT

for the

Army Air Forces, Air Technical Service Command

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INTRODUCTION

A recent trend in the design of long-range airplanes has been toward the use of high wing loadings and large aspect ratios. As a result of this trend, full-span flaps are often required for satisfactory take-off and landing characteristics, and the problem of obtaining adequate lateral control in conjunction with a full-span flap has presented itself.

At the request of the Army Air Forces, Air Technical Service Command, lift tests of a two-dimensional airfoil model equipped with a double-slotted flap and lateral-control device were made in the Langley two-dimensional low-turbulence pressure tunnel. The model represented the master outboard wing section (station 950) of the proposed Douglas C-74 airplane. The tests were made for the most part at a Reynolds number of approximately 6,000,000, primarily for the purpose of determining the flap settings which would give adequate maximum lift and lateral control characteristics for both the take-off and landing conditions. Several additional tests were made to determine the effect of Reynolds number, roughness, and sealed gaps on the lift characteristics.

COEFFICIENTS AND SYMBOLS

The coefficients and symbols used herein are defined as follows:

c_l section lift coefficient

a_0 section angle of attack measured from the model reference line (degrees)

δ_f flap deflection (degrees)

δ_R aileron deflection (degrees)

δ_L flip deflection (degrees)

Δa_0 increment of section angle of attack (degrees)

c model chord (inches)

R Reynolds number

MODEL

The model, submitted by the Douglas Aircraft Company, represented the master outboard wing section (station 950) of the proposed C-74 airplane and was a 24-inch-chord, two-dimensional Douglas wing section having the contour of an NACA 7-series type airfoil. Ordinates for the plain airfoil, given in percent of the chord and measured with respect to the wing reference line, are presented in table I. Photographs of the model are shown in figure 1. The general outline of the model, which had a maximum thickness of 0.1536c and which was equipped with a double-slotted flap, contour Frise aileron (aileron), and slot-lip aileron (flip), is shown in figure 2.

Figure 3 shows the arrangement of the control surfaces in their neutral positions, flap retracted and deflected 50°. Also included in figure 3 are the dimensions of the control surfaces and the location of their hinge lines. The double-slotted flap consisted of two parts. The forward portion of the flap, designated as a vane, was separated from the main part, designated

the rear flap, by a secondary slot. The double-slotted
flap, which operated as a unit with no relative motion
between the vane and the rear flap, rotated about a
fixed hinge line located below the model. The aft
portion of the rear flap, which was separated from the
forward portion of the rear flap by a tertiary slot, was
used as an aileron and rotated with respect to the flap.
A rear portion of the upper surface of the model was used
as a flip which was movable about a hinge line fixed in
the model.

TESTS

Most of the included data were obtained at a
Reynolds number of approximately 6,000,000 using the
test methods described in reference 1, primarly for the
purpose of approximating the flight Reynolds number for
the landing condition which is estimated to be about
5,400,000. These data have been corrected for tunnel-
wall constriction by the following formula:

$$c_l = 0.975 \ c_l'$$

where the primed quantity represents the value of the
lift coefficient measured in the tunnel. Some lift
characteristics were obtained at Reynolds numbers of
approximately 3,000,000 and 9,000,000 which correspond
to dynamic pressures of approximately 26 and 96 pounds
per square foot and Mach numbers of approximately 0.060
and 0.100, respectively. The pressure of the air in the
tunnel was varied between absolute pressures of approxi-
mately 30 and 95 pounds per square inch. Standard
roughness was applied to the leading edge of the model
by the methods described in reference 1. In addition, a
test was made with transition fixed on the upper surface
of the model. This was done by applying a 3-inch-wide
roughness strip, located just forward of the flip, over
the whole span of the model. Another test was conducted
with roughness on the entire lower surface of the flip.
The sealed conditions were simulated by inserting modeling
clay in the gaps. An outline of the test program is given
in table II.

Because of the large number of tests involved in
determining the characteristics of the lateral-control

surfaces at any particular flap setting, a preliminary
survey was made to facilitate the choice of flap settings
(primarily for landing) for which more complete tests
would be made. For this preliminary survey, with the
lateral-control surfaces neutral, the lift characteristics
were obtained at flap deflections of 0°, 10°, 20°, 30°,
40°, 50°, 52.5°, and 55°. Additional tests were made to
determine the effectiveness of the aileron and flip at
the selected flap deflections and to study the causes of
the flap stall.

RESULTS AND DISCUSSION

Maximum Lift Coefficient

Variation with flap deflection.- In order to be
certain that satisfactory maximum lift coefficients were
obtainable with the present arrangement of the control
surfaces and the flap, a series of tests were made with
the flap retracted and deflected in small increments to
a maximum of 55° (control surfaces neutral). The results
of these tests, presented in figure 4, appear to be
normal for flap deflections through 40° and indicate that
the maximum section lift coefficient increases from 1.62
with the flap retracted to 3.13 with the flap deflected
52.5°. With the flap deflected 50° the flow is unstalled
only for section angles of attack less than -16° although
at this flap deflection the maximum section lift coef-·
ficient was 3.07 as compared with 2.85 for the flap in
the 40° position. Because of the small changes in
section lift coefficient for flap deflections of 52.5°
and 55°, the flow appears to be partially stalled
throughout the entire range of angles of attack investi-
gated for these flap settings. With the flap deflected 55°,
a hysteresis effect in the lift curve is observed between
angles of attack of 0° and 14°. Although a maximum
section lift coefficient of 3.13 was obtained for the
52.5° flap deflection, subsequent tests were limited to
maximum flap deflection of 50° in order to be sure of
avoiding the dangerous hysteresis characteristics
occurring with the flap deflected 55°.

Effect of sealing various gaps.- The results of the
tests with the aileron gap sealed (not faired) and with
all the gaps open are presented in figures 5, 6, 7, and 8
for flap settings of 0°, 25°, 45°, and 50°, respectively,

with the flip neutral and with the aileron deflected.
Figure 9 presents the results of the tests with various
gaps sealed for the configuration with the flap retracted
and with the control surfaces neutral. Values of the
maximum section lift coefficient obtained at several flap
deflections, gaps sealed and unsealed, are tabulated
below for the condition with the control surfaces
neutral.

Configuration	Maximum section lift coefficient			
	Flap deflection, δ_f			
	0°	25°	45°	50°
All gaps open	1.62	2.37	2.90	3.07
Aileron gap sealed	1.53	2.13	2.90	3.15
Flip gap sealed	1.63	----	----	----
Gap A and flip gap sealed	1.64	----	----	----
Gap A faired, aileron gap sealed	1.54	----	----	----
All gaps faired	1.54	----	----	----

Sealing the aileron gap reduced the maximum section lift
coefficient with the flap retracted regardless of the
condition of the other gaps. Sealing the aileron gap
resulted in an increase in the maximum section lift coef-
ficient with the flap deflected 50°.

Aileron and Flip Effectiveness

The lift characteristics obtained in determining the
aileron and flip effectiveness at the four previously
tested flap settings of 0°, 25°, 45°, and 50° are shown
in figures 5 to 8 and 10 to 15. Data from these figures
are presented in figures 16, 17, 18, and 19 as the
variation of the increment of section angle of attack $\Delta\alpha_o$
with aileron deflection, for various deflections of the
flip, at a lift coefficient which was constant for each
flap setting. It is observed in figures 16 and 17, with
the flip neutral and with the flap deflected 0° and 25°,
respectively, that sealing the aileron gap had no
appreciable effect on the variation of $\Delta\alpha_o$ with aileron
deflection. At flap deflections of 45° and 50°, however,
with the flip neutral (figs. 18 and 19), sealing the
aileron gap resulted in a reversal of $\Delta\alpha_o$ for all

positive aileron deflections investigated. Figure 18
shows that for the flip-neutral condition ($\delta_f = 45^\circ$),
the aileron is ineffective for small deflections.
Between aileron deflections of about -2° to -7°, with the
flip neutral, the increment of section angle of attack
increases rapidly and is about the same for both
conditions of the aileron gap. For aileron deflections
more negative than about -7°, however, $\Delta\alpha_0$ is greater
when all gaps are open. For all negative aileron settings
investigated with the flap extended 50° and with the flip
neutral, the increment of section angle of attack is
larger when the aileron gap is sealed (fig. 19).

It is observed in figures 17, 18, and 19, (all gaps
open) that for all aileron deflections investigated a
sudden increase of $\Delta\alpha_0$ with flip deflection results at
progressively smaller negative flip deflections as the
flap is deflected. The sudden increase of $\Delta\alpha_0$ is
attributed to the separation of the air flow over the
flap, this separation being more readily induced at flap
deflections above 40°. (See fig. 4.)

A comparison of the flip effectiveness for various
flap deflections with the aileron neutral is shown in
figure 20. Since the complete range of flip deflections
was not covered in the tests with the aileron neutral
and with the flap deflected, some of the values of $\Delta\alpha_0$,
shown in figure 20, were obtained by extending the curves
shown in figure 17, 18, and 19. It is seen from figure 20
that, in general, the flip effectiveness increases with
flap deflection. This substantially agrees with the
data of references 2 and 3. A comparison of figures 17
and 20 shows that for a flap deflection of 25° the flip
is about equally as effective as the aileron. Above flap
deflections of 25°, however, the flip becomes considerably
more effective than the aileron.

It is noted in figure 15(b) that there is a serious
break in the lift curve at a section angle of attack of 0°
for the configuration with the flap, aileron, and flip
deflected 50°, 0°, and -5°, respectively. Further
increases in the flip deflection to -7° and -10° resulted
in a complete breakdown of the air flow over the flap
throughout the entire range of angles of attack investi-
gated. No evidence of the above discontinuities is
indicated from the results of figures 12 and 21 for a
similar configuration of the control surfaces with the

flap deflected 45°, although it is apparent from the
results of figure 12 that a gradual change in air flow
over the flap occurs between flip deflections of -6° and -8°
with the aileron deflected -5°. With the present
arrangement of the control surfaces, therefore, the
45° flap deflection is approximately the largest flap
deflection that gives lateral control characteristics
free from the anomalous behavior shown in figure 15(b).

Study of Flap Stall

In an attempt to study the causes of the sharp
break in the lift curve first noticed with the flap,
aileron, and flip deflected 50°, 0°, and -5°, respectively,
and to determine the range of configurations over which
the aforementioned break in the lift curves might exist,
the following tests were made:

    (1) Aileron gap sealed, not faired (fig. 22)

    (2) Roughness applied to the bottom of the flip
           and then to the upper surface of the airfoil
           just forward of the flip (fig. 23)

    (3) Flip gap sealed, faired, and not faired (fig. 24)

    (4) Reynolds number varied (fig. 24)

    (5) Roughness applied to the leading edge of the
           model (fig. 25)

Sealing the aileron gap or applying roughness to
the entire lower surface of the flip and then applying a
3-inch roughness strip to the upper surface of the airfoil
just forward of the flip had little effect in changing
the extent of the break in the lift curve (figs. 22 and 23).
Sealing the flip gap reduced the extent of the break
although the resulting hysteresis effects remain objec-
tionable. Little scale effect is noted between Reynolds
numbers of 6,000,000 and 9,000,000 (fig. 24). Decreasing
the Reynolds number to 3,000,000 entirely eliminated the
irregularity in the lift curve; however, accompanying
the decrease in Reynolds number was a large loss in
section lift coefficient over the complete range of
angles of attack investigated. Due to this phenomenon it
is thought that if future investigations of control
surfaces, similar to that considered in the present

report, are made at low Reynolds numbers, the results of
these investigations should be checked at flight Reynolds
numbers before application to an aircraft.

A comparison of the lift characteristics obtained
with the leading edge of the model in the smooth and
rough condition is presented in figure 25 for the
configurations with the aileron neutral and with the flap
and flip deflections varied. The results show that when
standard roughness was applied, the maximum section lift
coefficient was reduced about 0.4 for all flap deflections
investigated. With the model in the rough condition and
with the flap, aileron, and flip deflected 50°, 0°,
and -5°, respectively, a gradual change in the lift curve
occurs over a large range of angles of attack as opposed
to the anomalous behavior with the model in the smooth
condition.

Inasmuch as the landing Reynolds number of this
section of the C-74 wing will be within the range of
Reynolds number in which the severe air-flow breakdown
occurs, the 50° flap setting is not considered satis-
factory for the landing condition.

SUMMARY OF RESULTS

Tests of a Douglas airfoil section of NACA 7-series
type equipped with a lateral-control device for use with
a full-span double-slotted flap, indicated the following:

1. The control-surface arrangement tested may prove
satisfactory for lateral control provided all gaps are
unsealed and a flap deflection of 45° is not exceeded.

2. With the control surfaces neutral, a reduction
in the maximum section lift coefficient was obtained
whenever the aileron gap was sealed regardless of the
condition of the other gaps.

3. The flip is considerably more effective than the
aileron for flap deflections above about 25°.

4. The limited amount of data obtained at a low
Reynolds number indicated that the scale effects at

Reynolds numbers between 3,000,000 and 6,000,000 may be serious and should be considered in the development of similar lateral-control devices.

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2. Rogallo, Francis M., and Spano, Bartholomew S.: Wind-Tunnel Investigation of a Plain and a Slot-Lip Aileron on a Wing with a Full-Span Slotted Flap. NACA ACR, April 1941.

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TABLE I.- ORDINATES FOR A DOUGLAS AIRFOIL OF NACA 7-SERIES TYPE - STATION 950 OF C-74 WING

Stations and ordinates given in percent of airfoil chord

Station	Ordinate	
	Upper Surface	Lower Surface
0	2.0438	2.0438
.10	2.7158	1.4467
.25	3.1090	1.1406
.50	3.5635	.8398
1.00	4.2192	.4551
1.75	4.9511	.0566
2.50	5.5380	-.2543
3.75	6.3327	-.6756
5.0	6.9692	-1.0293
7.5	7.9373	-1.6307
10	8.6420	-2.1555
12.5	9.1662	-2.6325
15	9.5516	-3.0770
17.5	9.8244	-3.4969
20	10.0022	-3.8958
22.5	10.0975	-4.2750
25	10.1197	-4.6344
27.5	10.0760	-4.9734
30	9.9716	-5.2917
32.5	9.8109	-5.5894
35	9.5980	-5.8662
37.5	9.3370	-6.1209
40	9.0327	-6.3517

Station	Ordinate	
	Upper Surface	Lower Surface
42.5	8.6900	-6.5559
45	8.3130	-6.7306
47.5	7.9047	-6.8731
50	7.4677	-6.9788
52.5	7.0040	-7.0321
55	6.5154	-6.9937
57.5	6.0040	-6.8462
60	5.4723	-6.6152
62.5	4.9231	-6.3334
65	4.3592	-6.0309
67.5	3.7830	-5.7246
70	3.1967	-5.4213
72.5	2.6022	-5.1241
75	2.0019	-4.8357
77.5	1.3984	-4.5590
80	.7950	-4.2973
82.5	.1959	-4.0544
85	-.3928	-3.8338
87.5	-.9601	-3.6412
90	-1.4899	-3.4843
92.5	-1.9605	-3.3716
95	-2.3579	-3.3070
97.5	-2.6986	-3.2836
100	-3.0096	-3.2834

TABLE II
TEST PROGRAM

$\delta_f = 0°$

δ_R	δ_L = 0
-20	x
-15	a / x
-10	a / x
0	a, c, g, h / x, i, j
10	a / x
15	a / x
20	x

$\delta_f = 25°$

δ_R	δ_L							
	2	0	-3	-5	-7	-10	-15	-20
-15		a				x	x	x
-10		a				x	x	x
-5				x		x	x	
0	x	a / x	x	x	x	x		
5	x	x		x				
10	x	a / x						
15	x	a / x						

δ_f

δ_R, δ_L	10	20	30	40	52.5	55
0	x	x	j / x	x	x	x

$R \times 10^{6}$; $\delta_f = \delta_R = \delta_L = 0$

10	x
15	x

$R \times 10^{6}$; $\delta_f = 50°$, $\delta_R = 0°$, $\delta_L = -5°$

3	x
9	x

$\delta_f = 45°$

δ_R	δ_L						
	0	-5	-6	-8	-10	-15	-20
-15	a					x	x
-10	a / x	x			x	x	
-5	x	x	x	x	x		
0	a / x	d,e / x,f					
10	a / x						
15	a / x						

$\delta_f = 50°$

δ_R	δ_L								
	2	0	-3	-4	-5	-7	-10	-15	-20
-15		a / x							
-10		a / x					x	x	x
-5						x	x	x	
0	a / x, J	a / x	a	a, b, c / x, d, e / J		x	x		
2.5	x								
5	x								
7.5	x								
10	a / x								
15	a / x								

Symbol	Designation
x	All gaps open
a	Aileron gap sealed, not faired
b	Flip gap sealed, not faired
c	Flip gap sealed and faired
d	Roughness on bottom of flip
e	3-inch roughness strip forward of flip on upper surface
f	Aileron and flip gap sealed, not faired
g	All gaps sealed and faired
h	Aileron gap unsealed, other gaps sealed
i	Flip gap unsealed; aileron gap sealed but not faired; secondary slot sealed and faired
J	Leading-edge roughness

Note: R = 6,000,000 unless otherwise specified.

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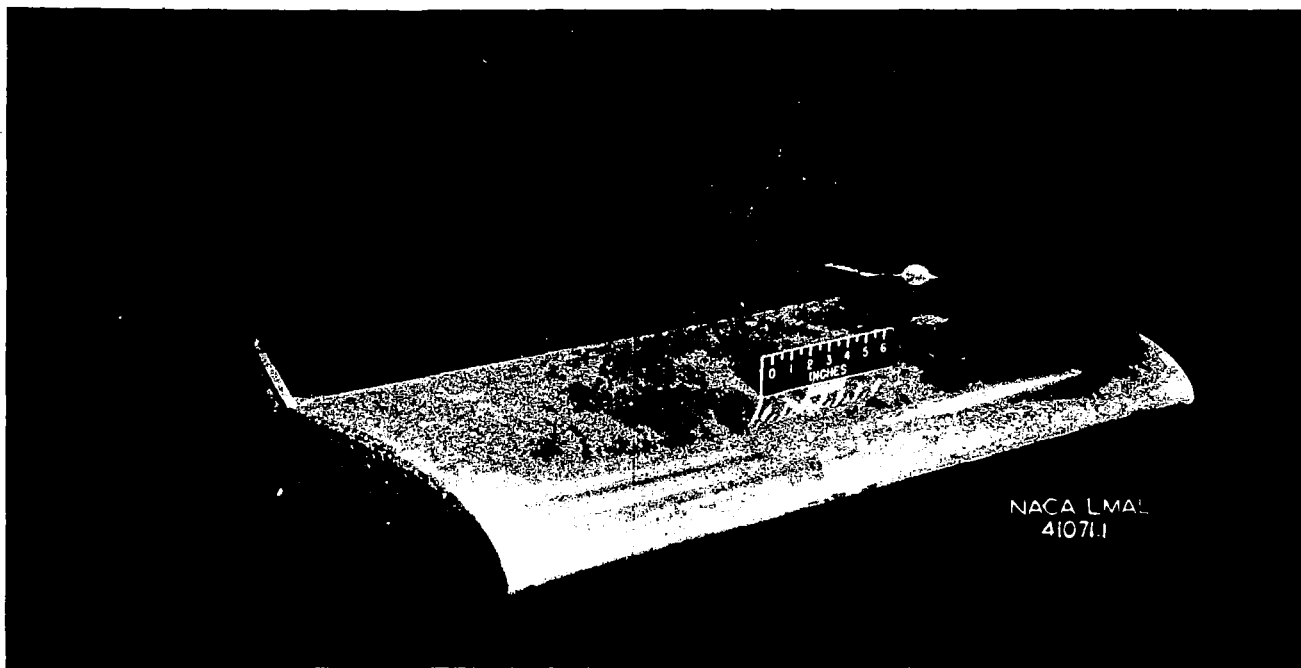
(a) Three-quarters front view of upper surface; $\delta_f = 0^O$.

Figure 1.- Photograph of a 24-inch chord Douglas airfoil of NACA 7-series type
with double-slotted flap, aileron and flip; station 950 of C-74 wing.

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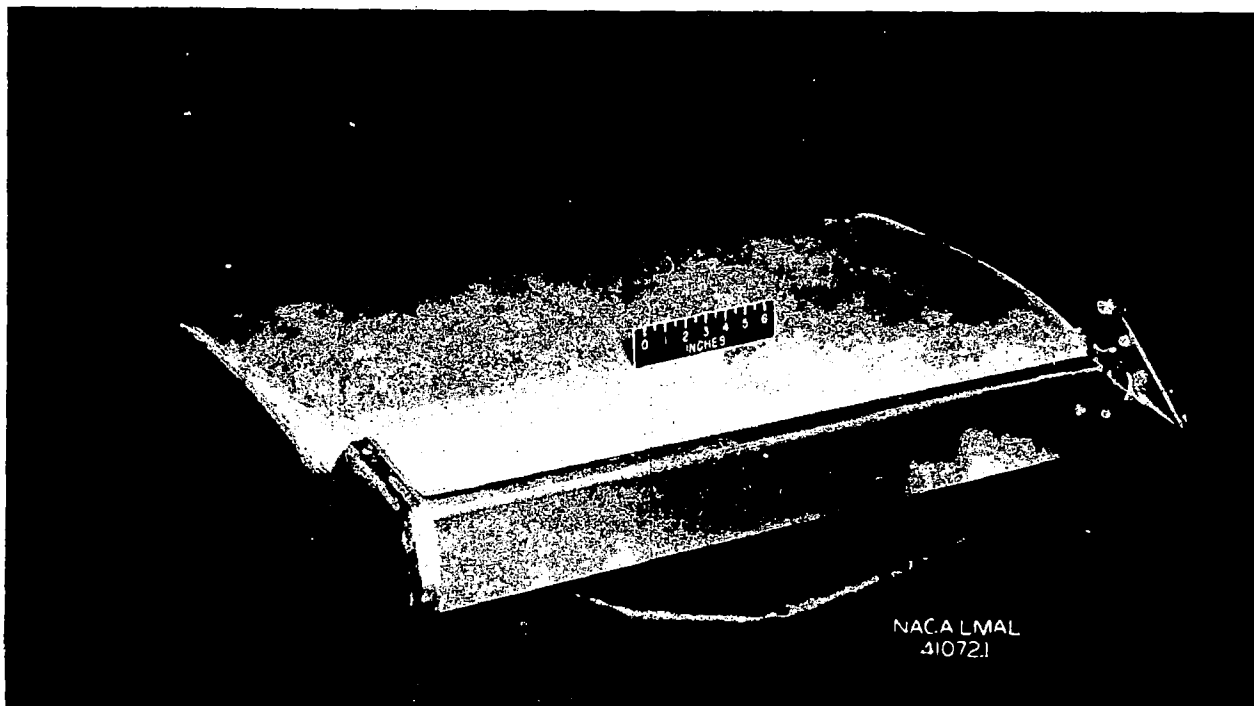
(b)   Three-quarters rear view of lower surface; $\delta_f = 0^\circ$.

Figure 1.- Continued.
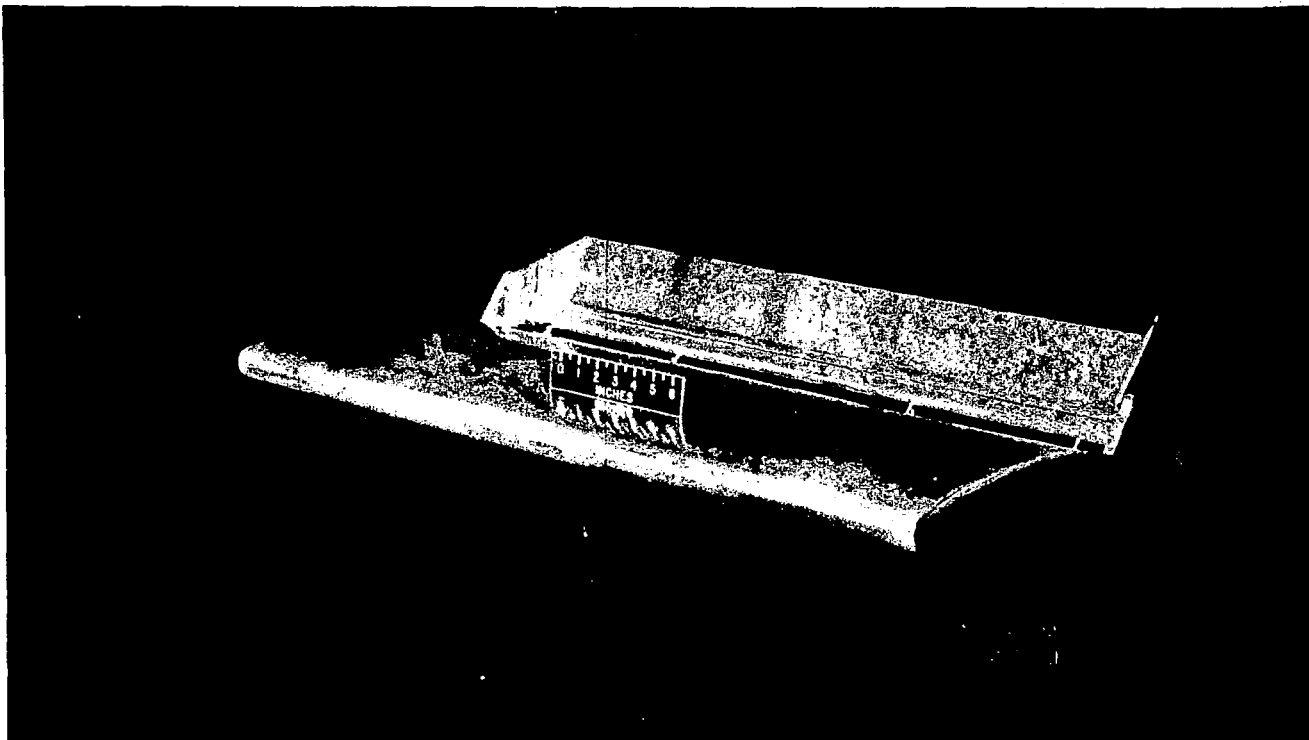
(c)   Three-quarters front view of lower surface; $\delta_f = 50^{\circ}$.

Figure 1.-   Continued.
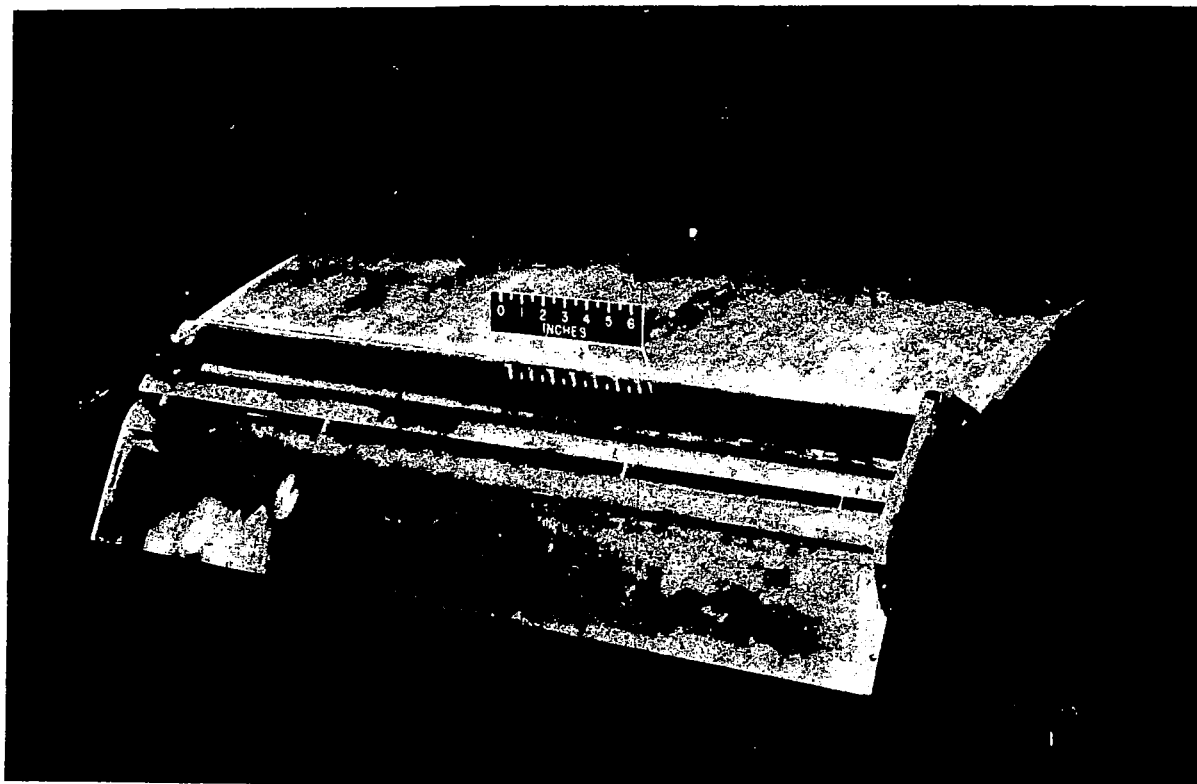
(d)   Three-quarters rear view of upper surface; $\delta_f = 50^\circ$.

Figure 1.- Concluded.

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4.81 degrees

Wing ref. line

Model ref. line

0.467c

Flip

Aileron

Flap
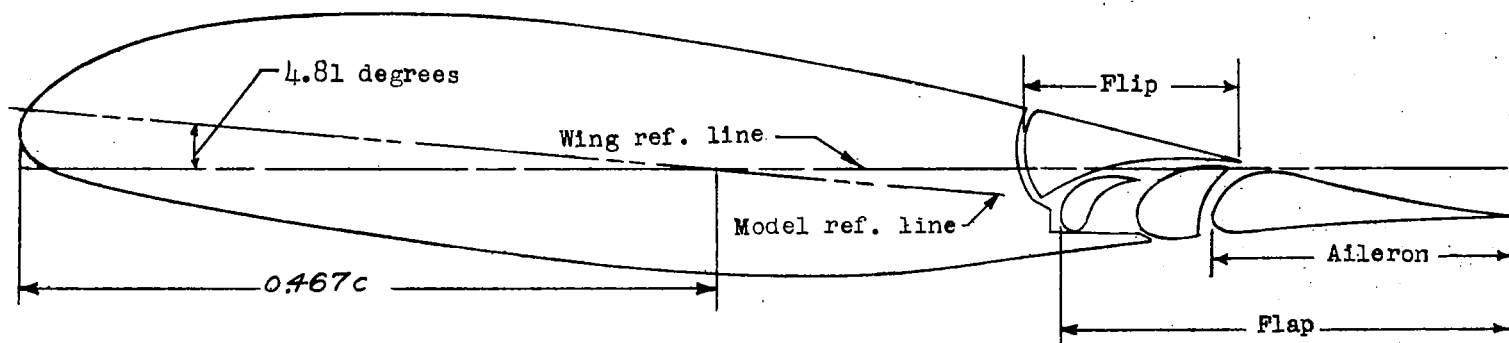
Figure 2.- Profile view of a 24-inch chord Douglas airfoil of NACA 7-series
type; station 950 of C-74 wing.

Figure 3.- Arrangement of control surfaces for a 24-inch chord Douglas airfoil of NACA 7-series type; station 950 of C-74 wing.
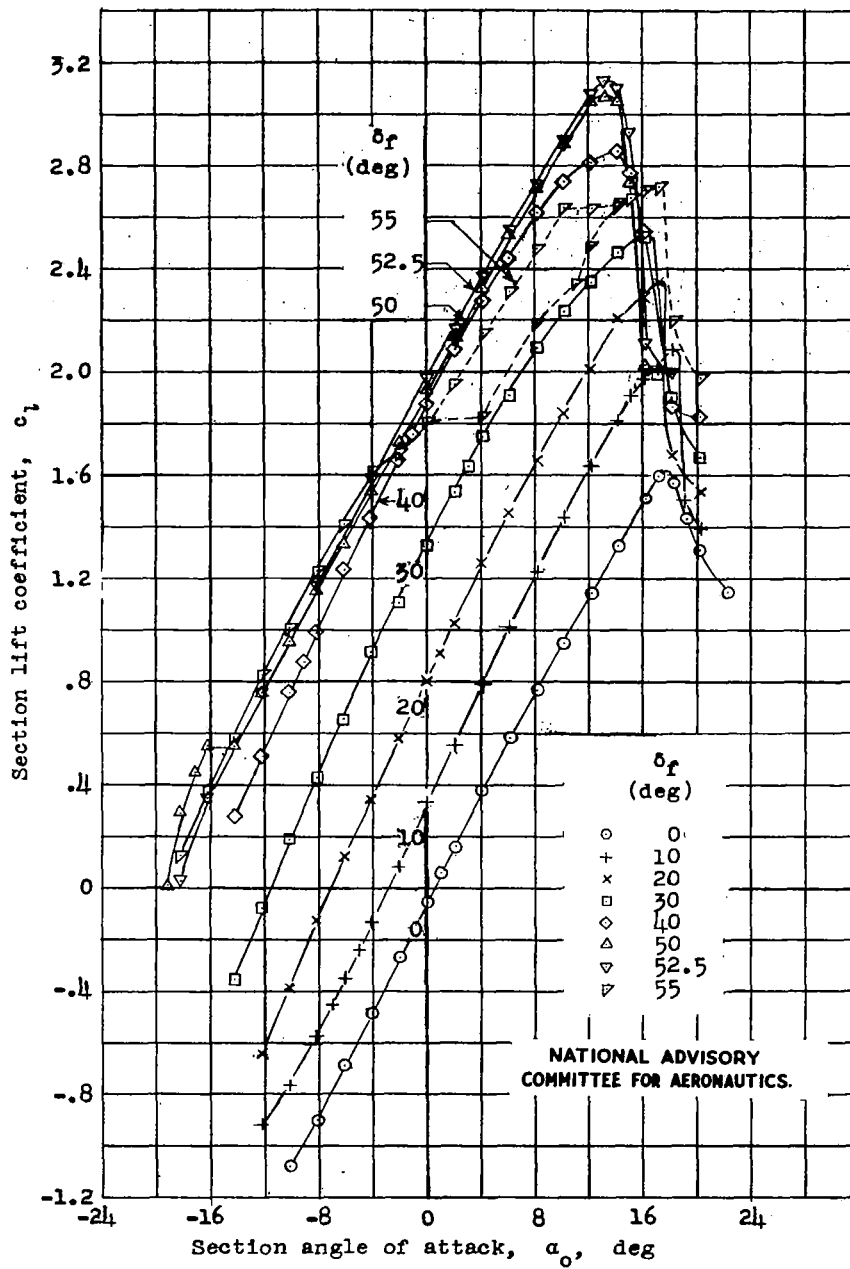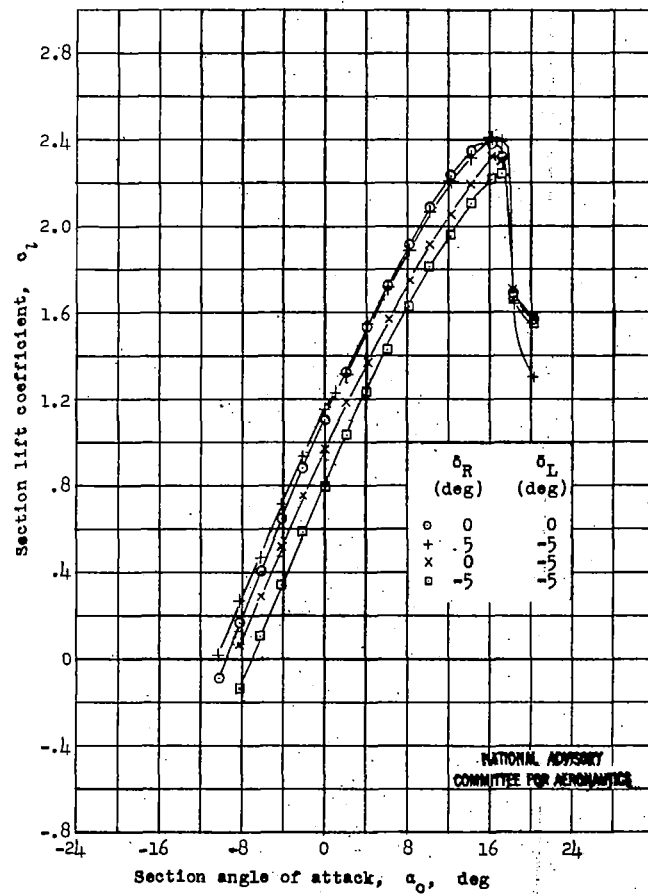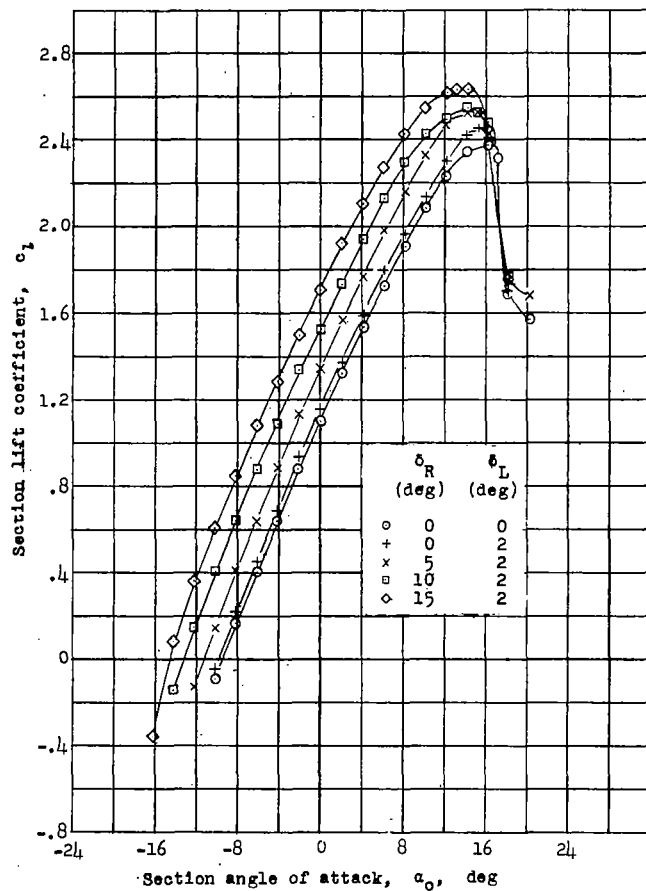
Figure 4 .- Lift characteristics of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_R = \delta_L = 0$; $R = 6.0 \times 10^6$. Test, TDT 391.
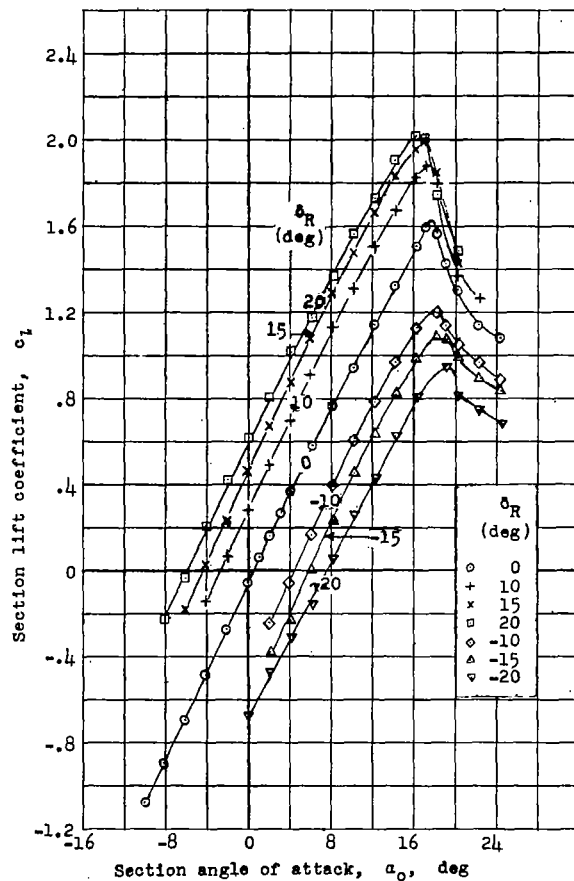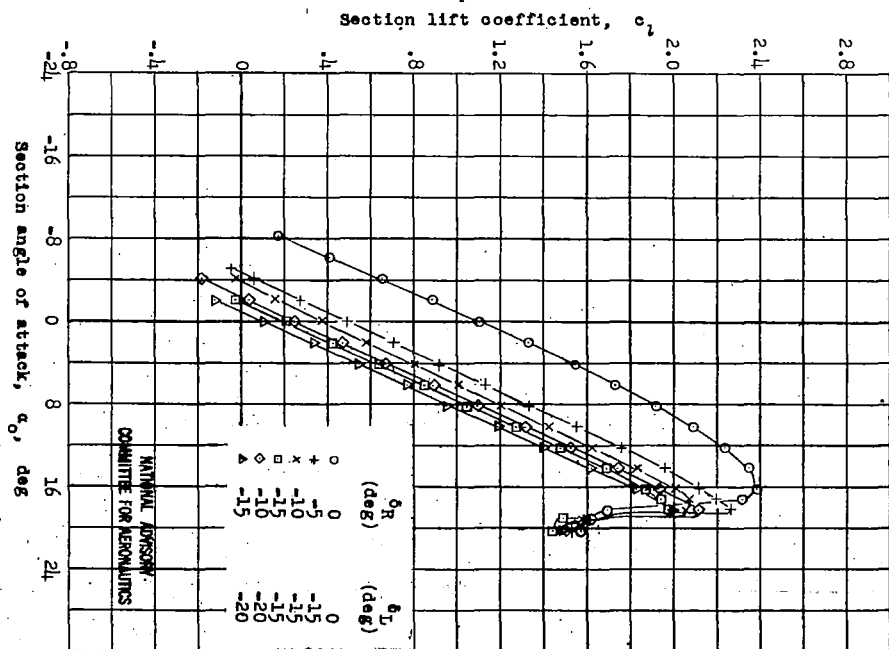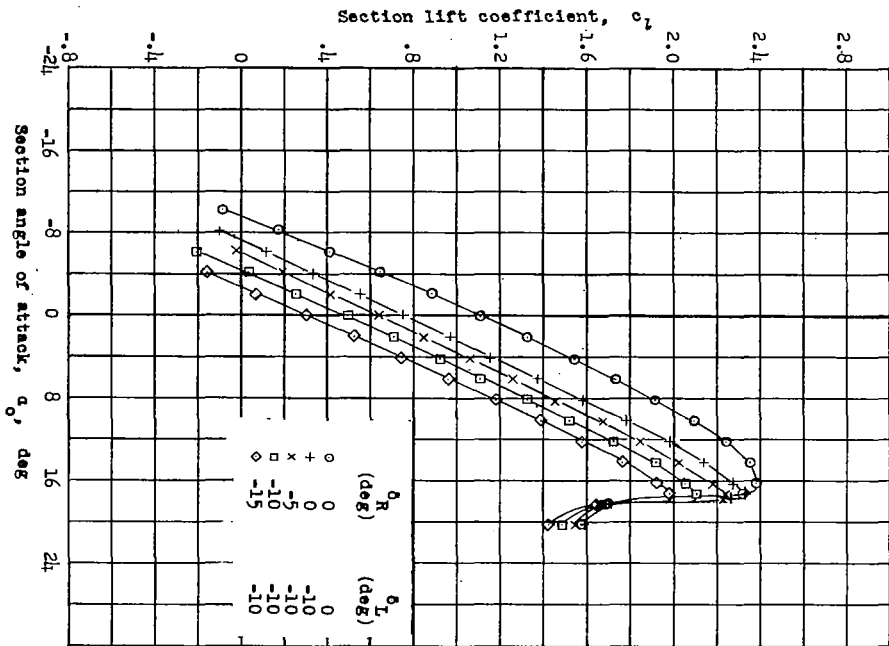
(a) All gaps open.
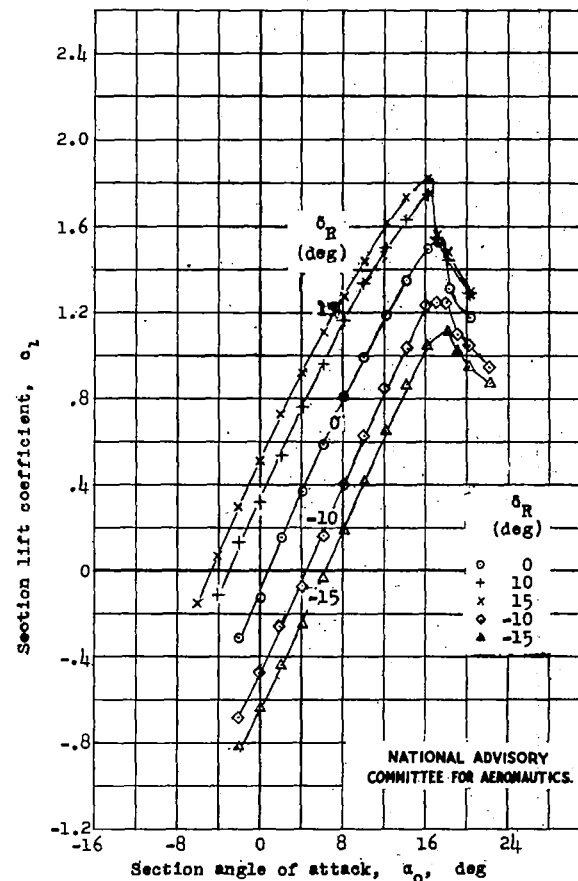
(b) Aileron gap sealed, not faired.

Figure 5 .- Lift characteristics of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_f = \delta_L = 0$; $R = 6 \times 10^6$.   Tests, TDT 391 and 395.
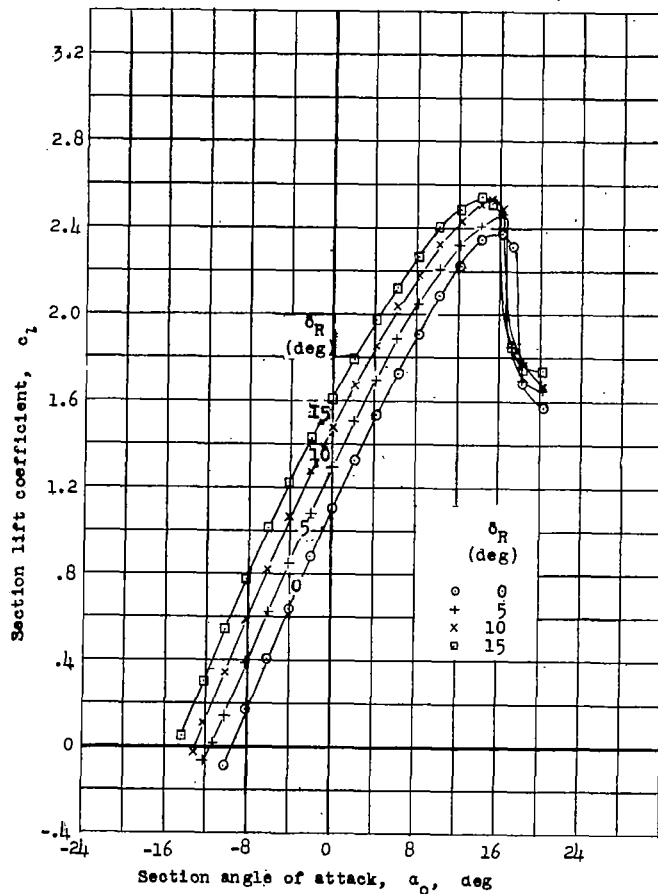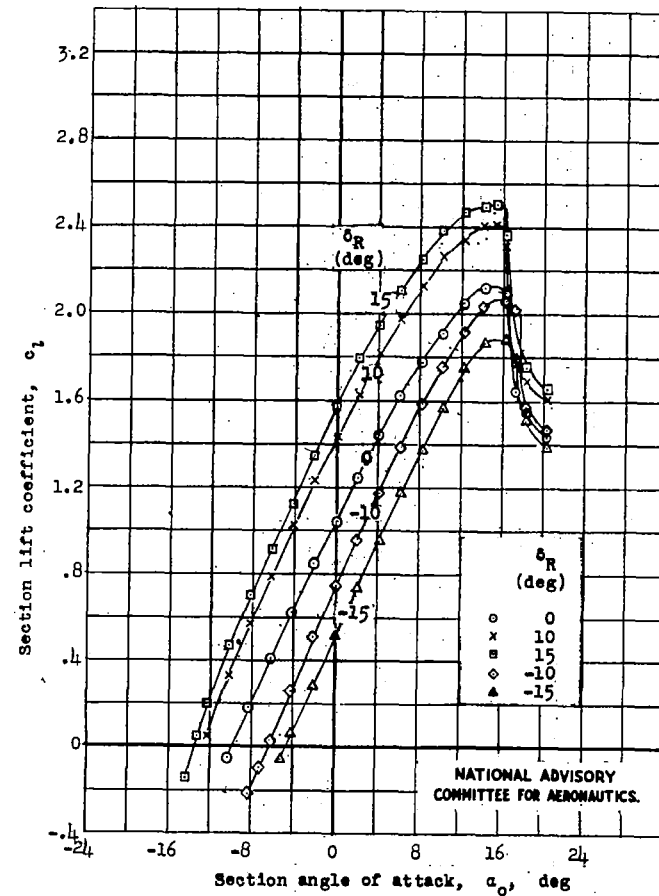
(a) All gaps open.

(b) Aileron gap sealed, not faired.

Figure 6 .- Lift characteristics of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_f = 25°$; $\delta_L = 0°$; $R = 6 \times 10^6$.   Tests, TDT 391 and 395.
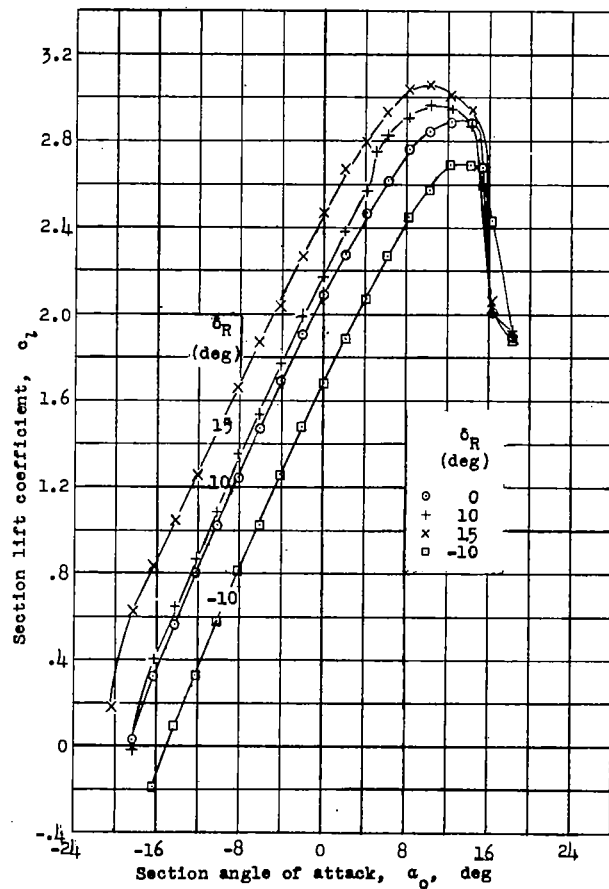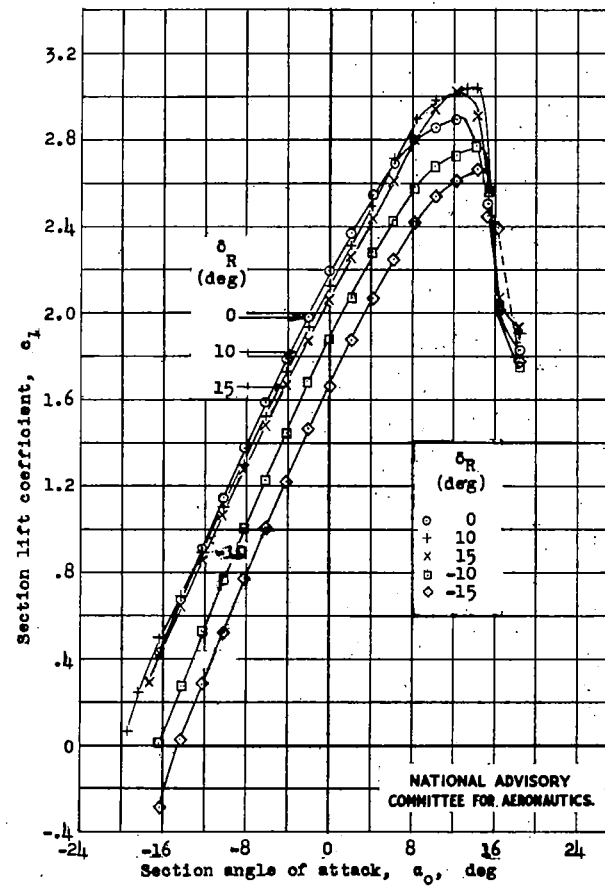
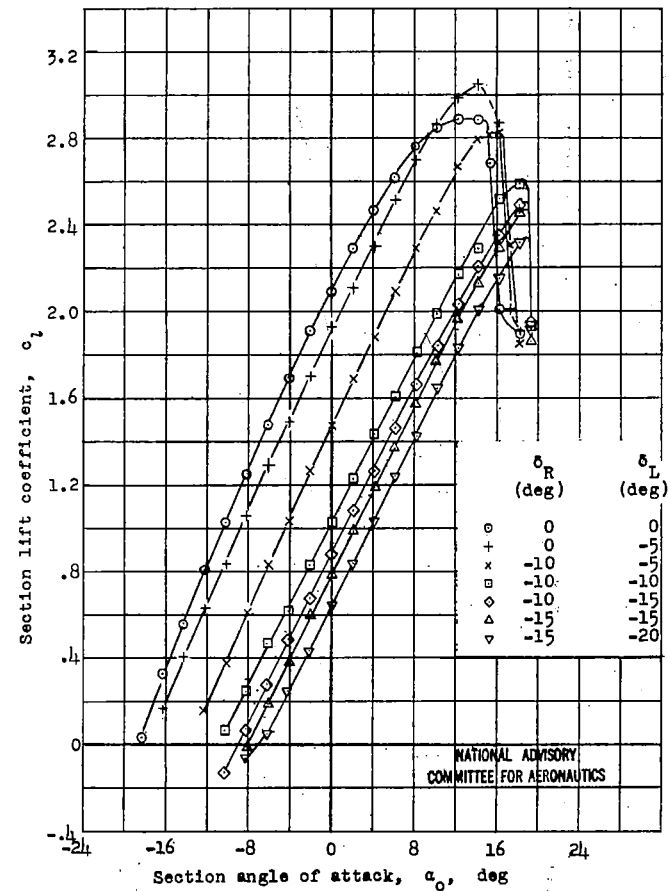(a) All gaps open.

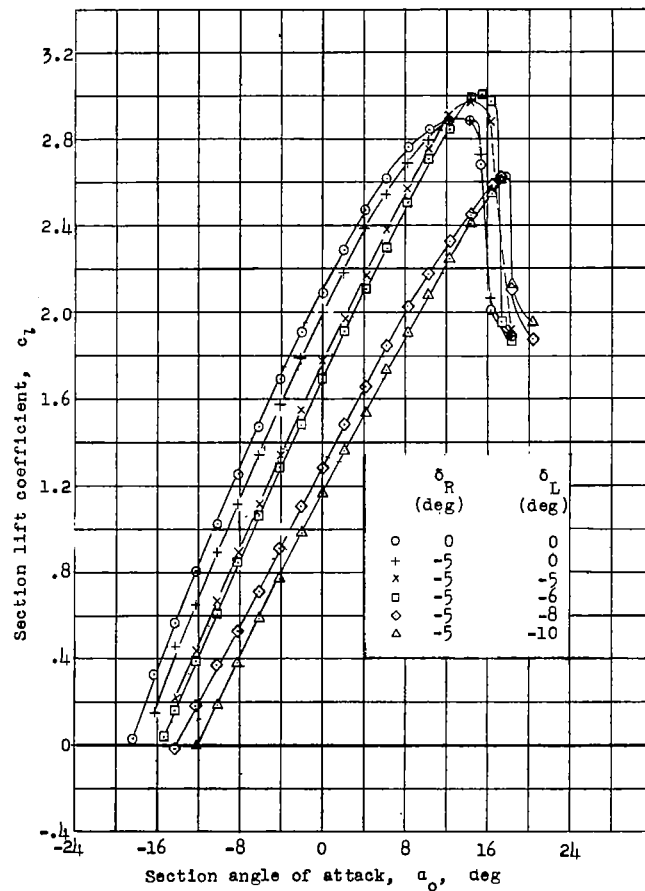(b) Aileron gap sealed, not faired.

Figure 7 .- Lift characteristics of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_f = 45°$; $\delta_L = 0°$; $R = 6 \times 10^6$. Tests, TDT 393 and 395.
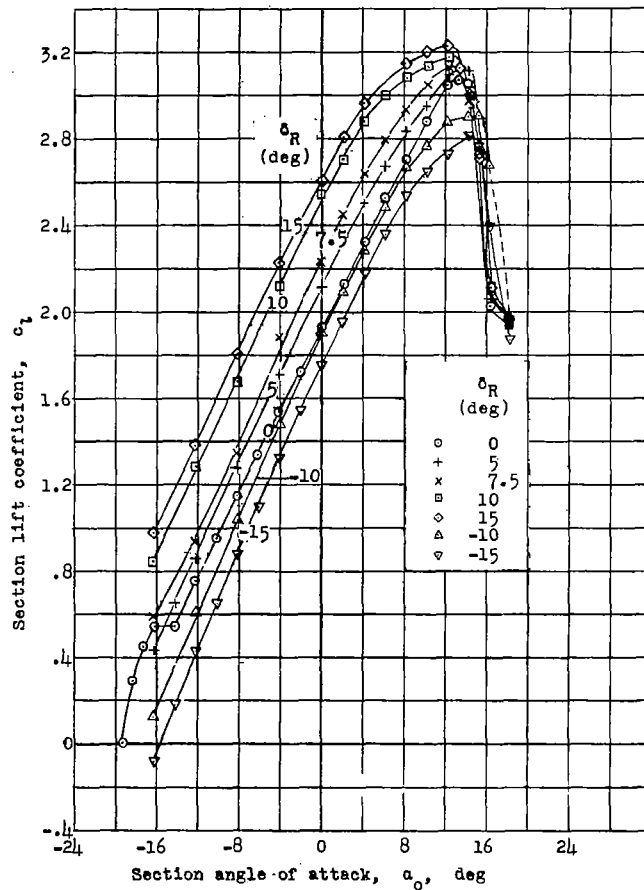
(a) All gaps open.
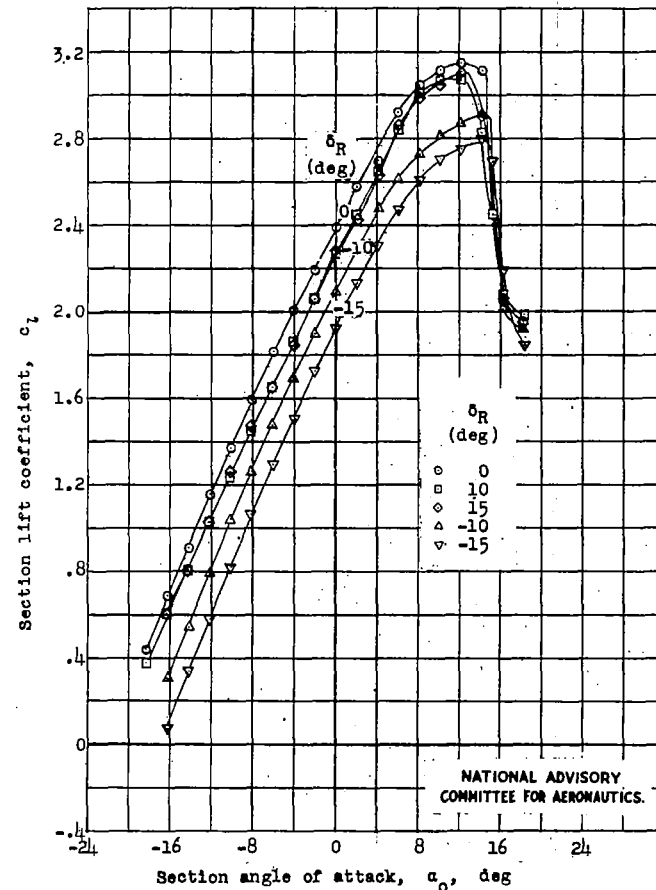
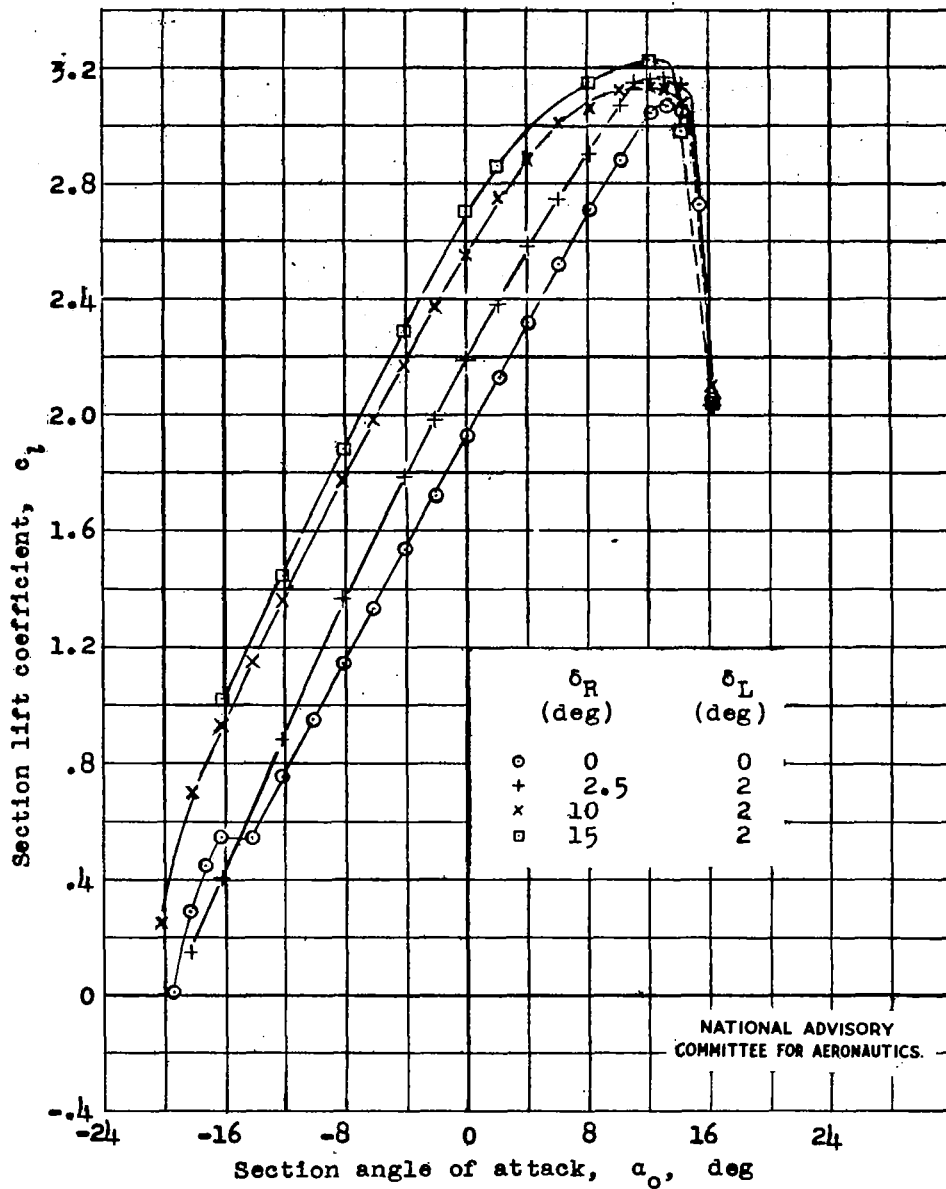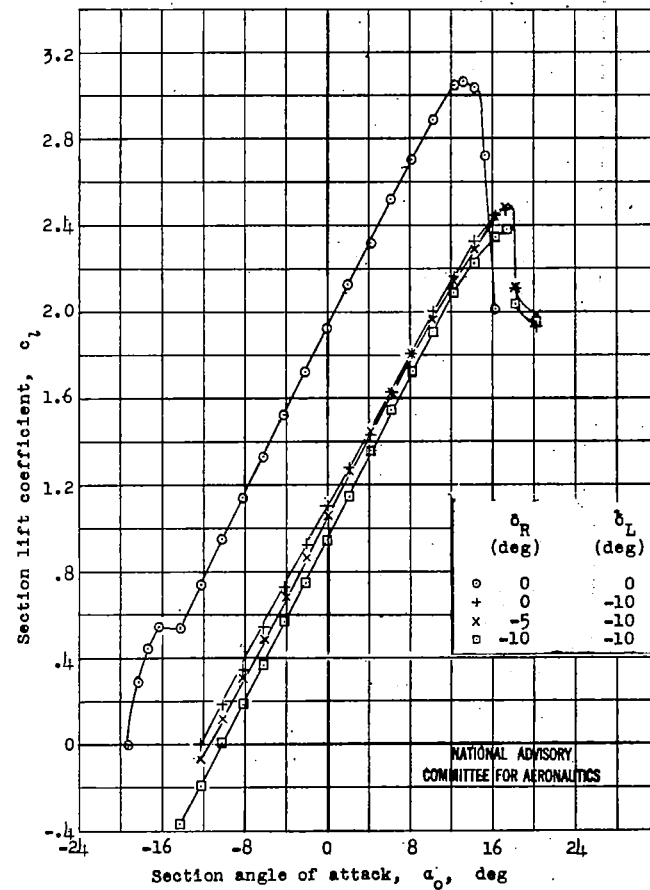(b) Aileron gap sealed, not faired.

Figure 8 .- Lift characteristics of a Douglas airfoil of NACA 7-series type, with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_f = 50°$; $\delta_L = 0°$; $R = 6 \times 10^6$. Tests, TDT 391 and 395.

Left graph:
- Y-axis: Section lift coefficient, c_l
- X-axis: Section angle of attack, α_o, deg
- Legend:
  - ⊙ All gaps open
  - ▫ All gaps sealed and faired
  - + Flip gap sealed, not faired

Right graph:
- Y-axis: Section lift coefficient, c_l
- X-axis: Section angle of attack, α_o, deg
- Legend:
  - ⊙ All gaps open
  - × Aileron gap unsealed; other gaps sealed and faired
  - ◇ Flip gap unsealed; aileron gap sealed but not faired; secondary slot sealed and faired
  - ▫ Aileron gap sealed, not faired
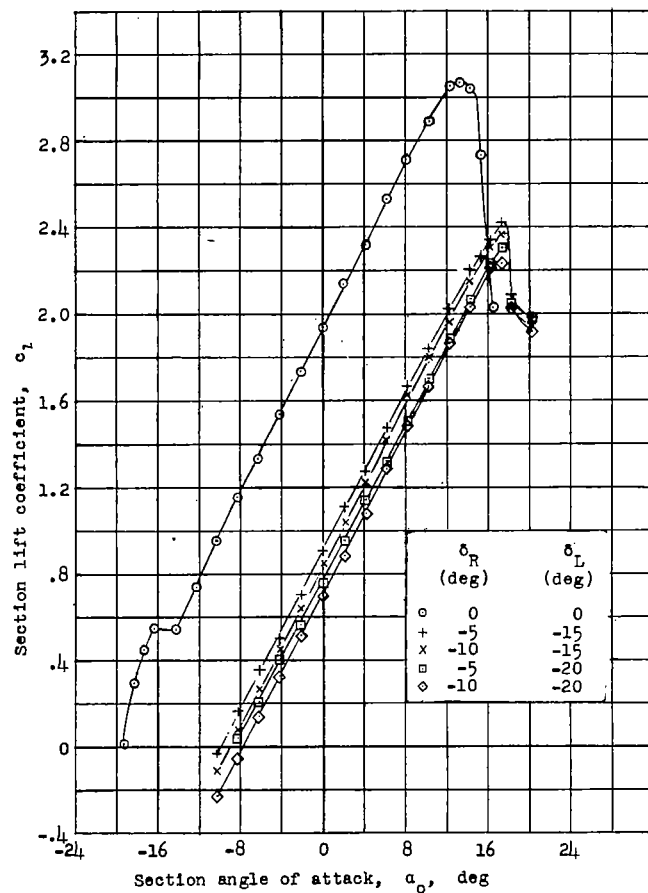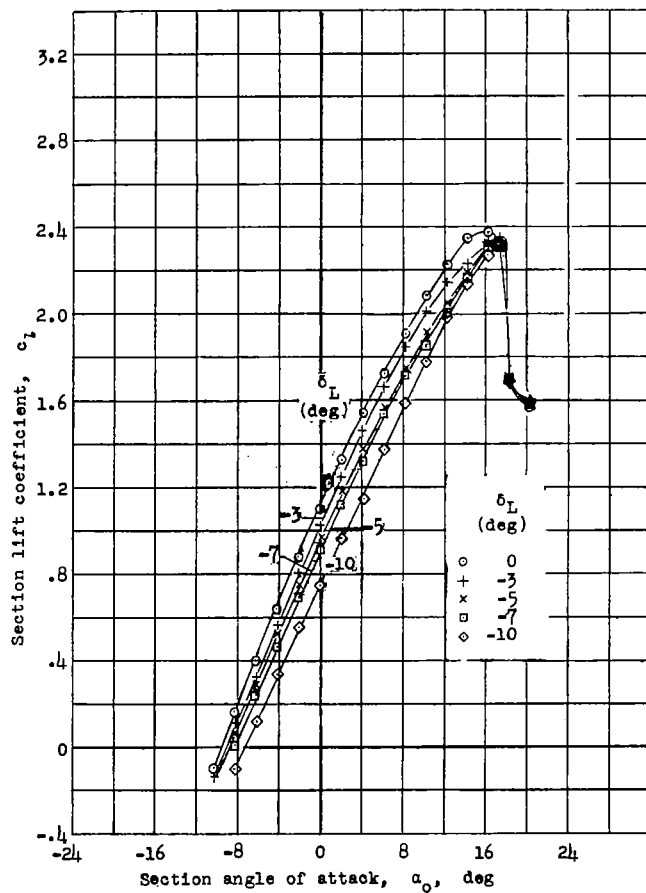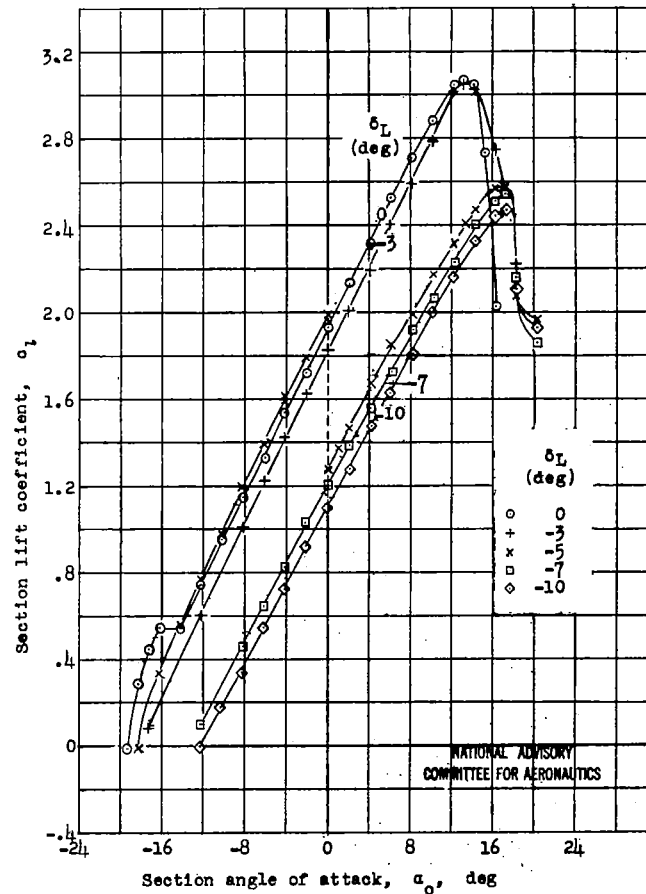
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Figure 9.- Lift characteristics of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_f = \delta_R = \delta_L = 0$; $R = 6 \times 10^6$. Test, TDT 391.

Figure /O .- Lift characteristics of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_f = 25°$; R = 6 × 10⁶.   Test, TDT 391.

Figure 11.- Lift characteristics of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flap, station 950 of C-74 wing. $\delta_f = 25°$; $R = 6 \times 10^6$. Test, TDT 391.
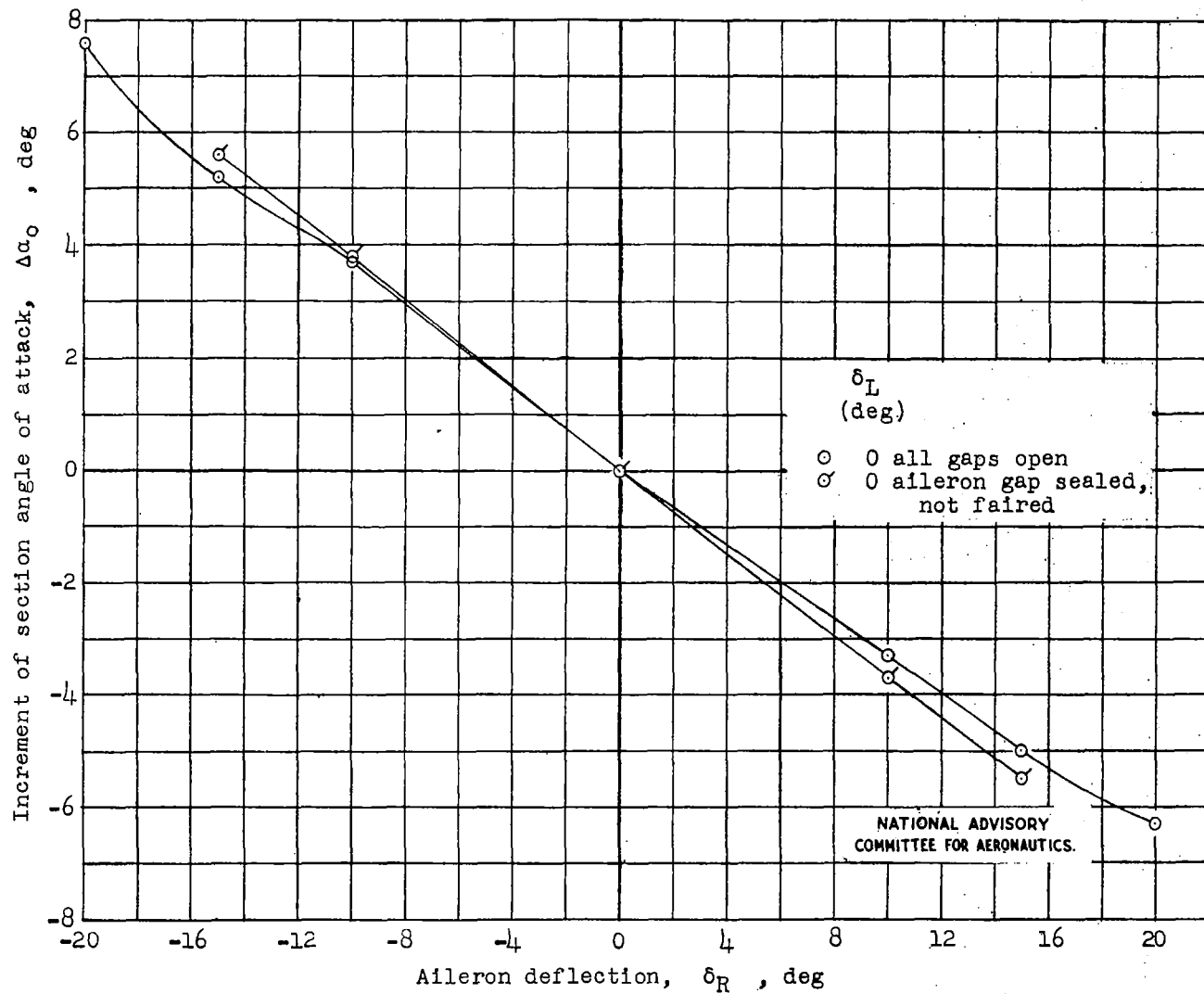
Section lift coefficient, c_l

δ_R (deg)	δ_L (deg)
○ 0	0
+ −5	0
× −5	−5
□ −5	−6
◇ −5	−8
△ −5	−10

Section angle of attack, α_o, deg

δ_R (deg)	δ_L (deg)
○ 0	0
+ 0	−5
× −10	−5
□ −10	−10
◇ −10	−15
△ −15	−15
▽ −15	−20

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Section angle of attack, α_o, deg

Figure 12.- Lift characteristics of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_f = 45°$; $R = 6 \times 10^6$. Test, TDT 393.
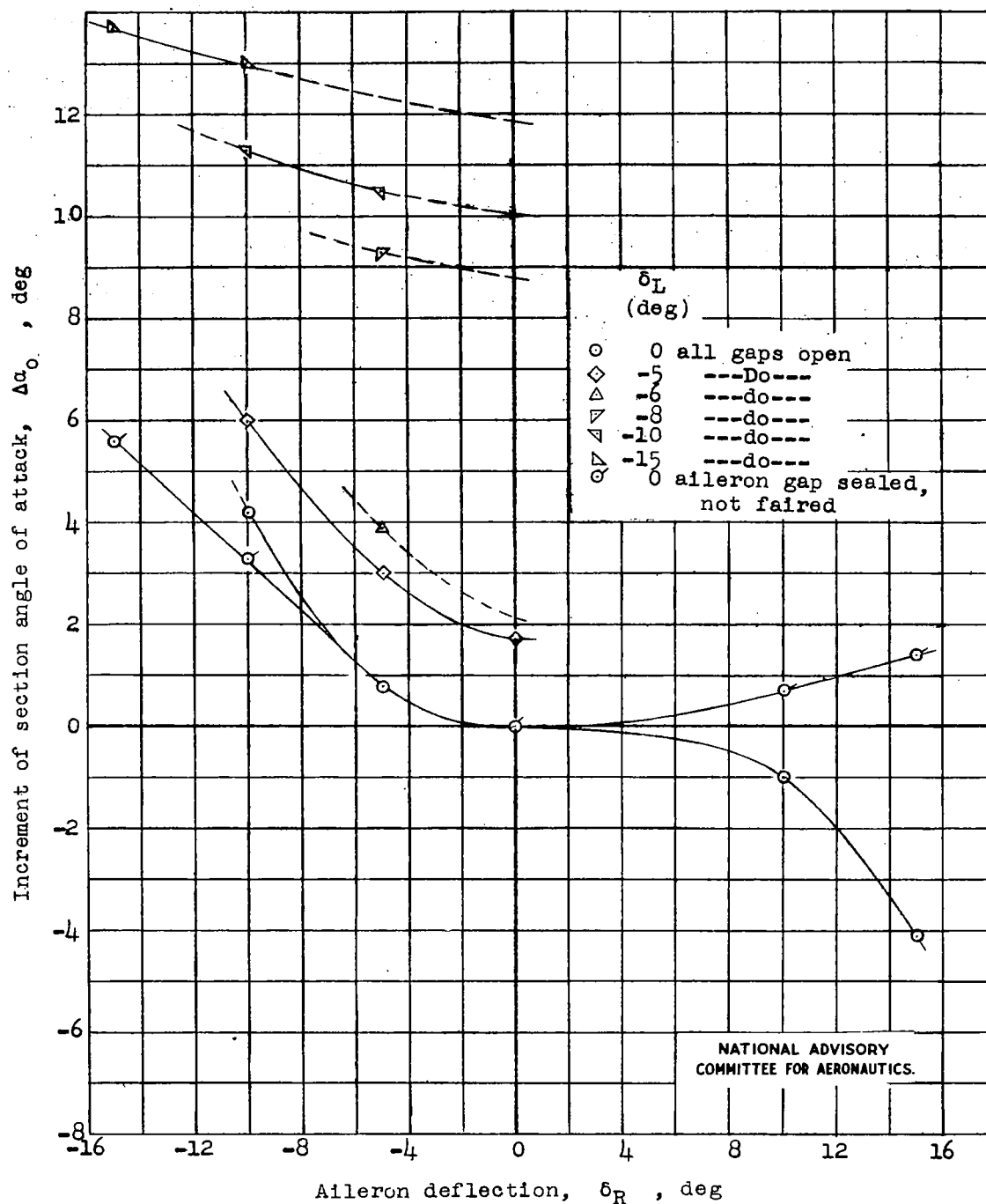
Figure /3.- Lift characteristics of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_f = 50°$; R = 6 × 10^6. Test, TDT 391.

Figure 14.- Lift characteristics of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_f = 50°$; R = 6 × 10⁶. Test, TDT 391.

(a) $\delta_f = 25°$.

(b) $\delta_f = 50°$.

Figure 15.- Lift characteristics of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_R = 0$; $R = 6 \times 10^6$. Test, TDT 391.
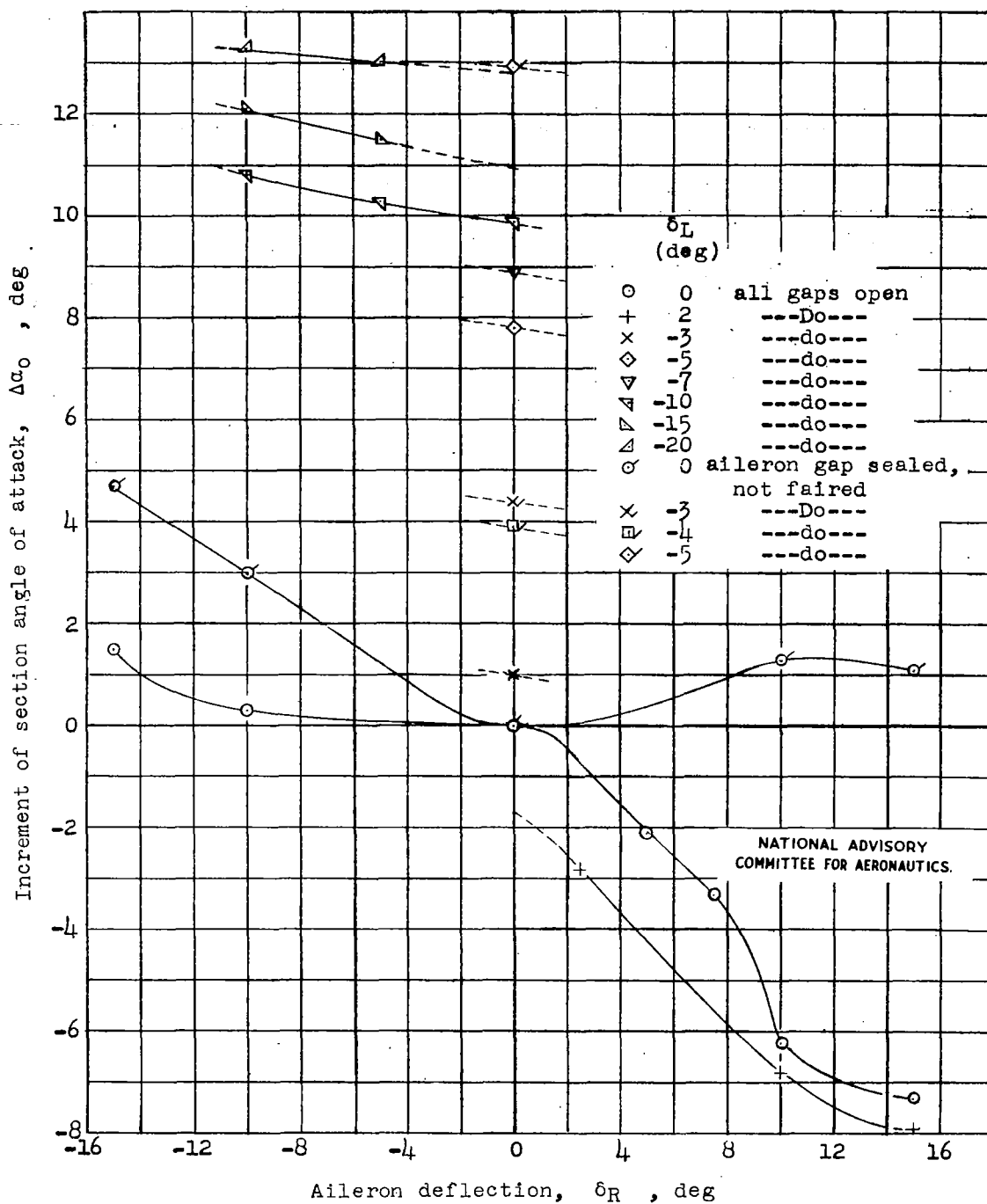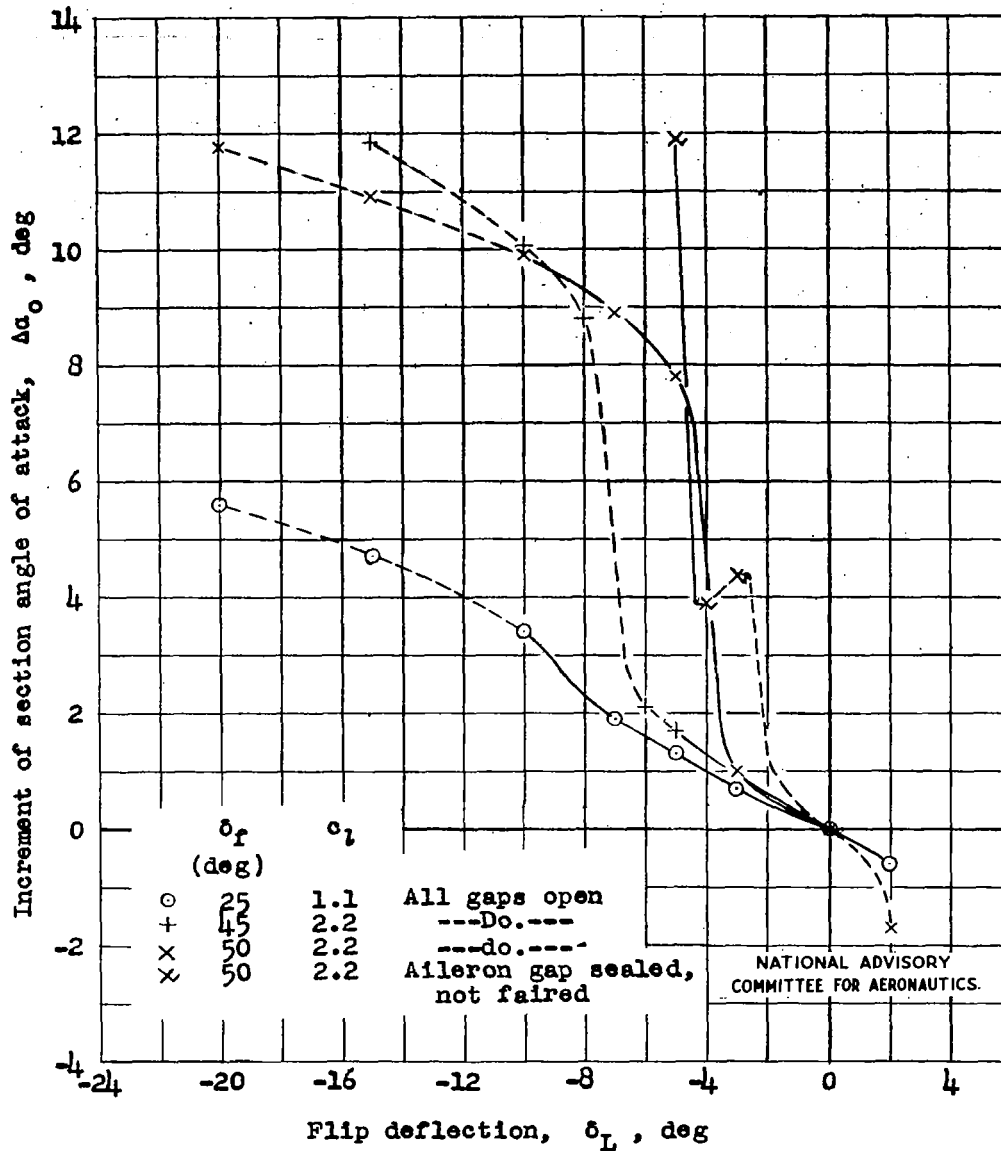
Figure /6.– Aileron and flip effectiveness of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_f = 0°$; $c_l = 0.4$; $R = 6 \times 10^6$. Tests, TDT 391, 393, 395.
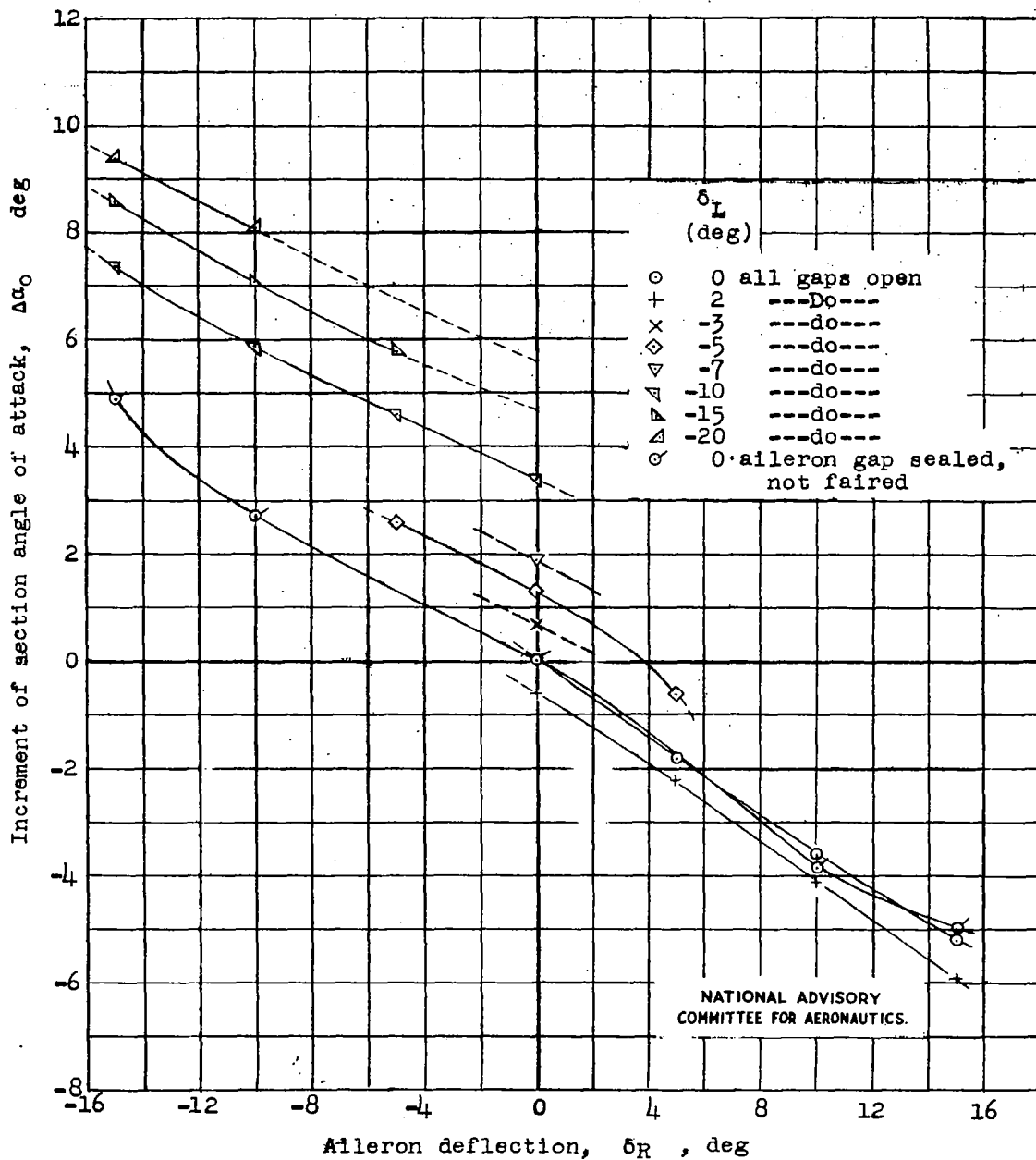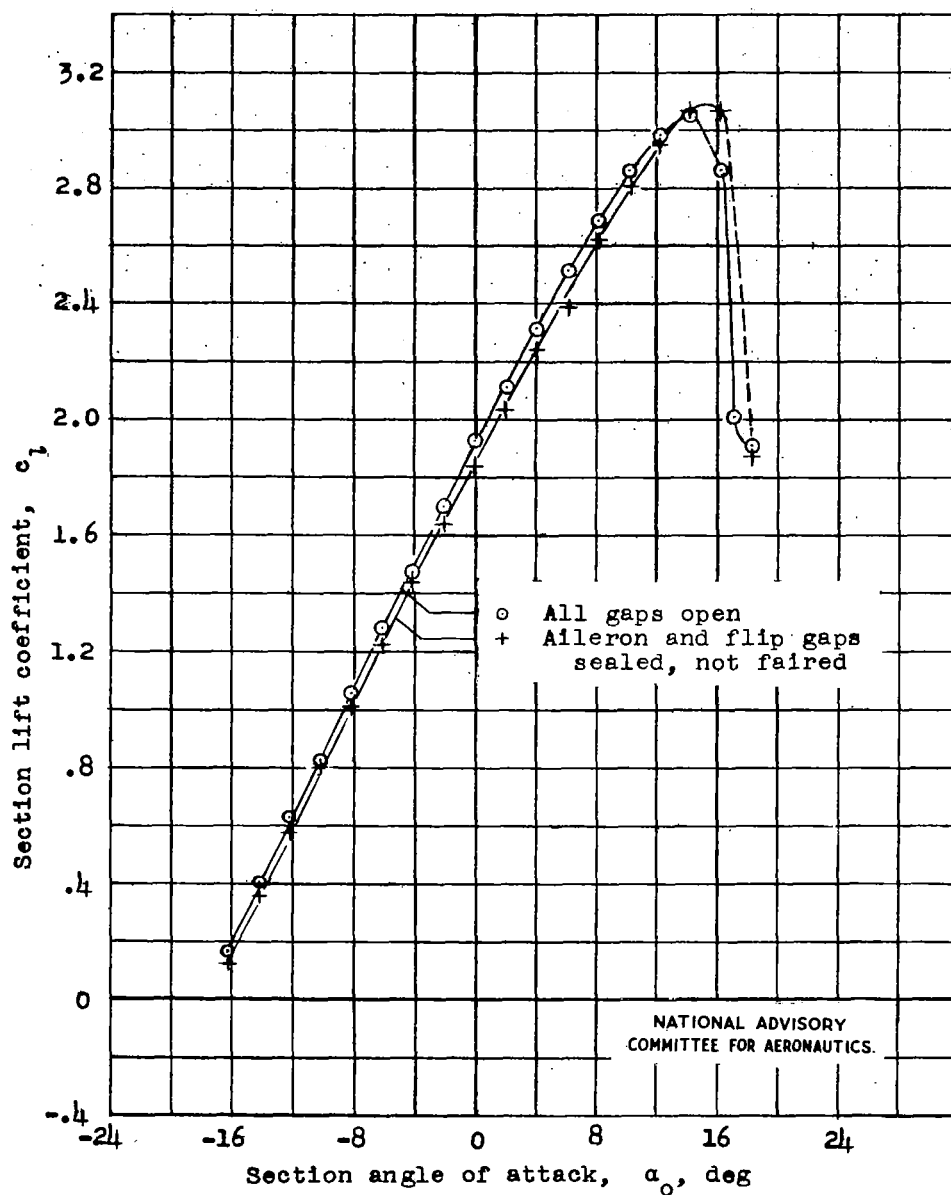
Figure 17.- Aileron and flip effectiveness of a Douglas airfoil
of NACA 7-series type with double-slotted flap, aileron, and
flip, station 950 of C-74 wing. $\delta_f = 25°$; $c_l = 1.1$; $R = 6 \times 10^6$.
Tests, TDT 391, 393, 395.

Figure /8 .- Aileron and flip effectiveness of a Douglas airfoil .
of NACA 7-series type with double-slotted flap, aileron, and
flip, station 950 of C-74 wing. $\delta_f = 45^\circ$; $c_l = 2.2$; $R = 6 \times 10^6$.
Tests, TDT 393, 395.

Figure /9.- Aileron and flip effectiveness of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_f = 50^\circ$; $c_l = 2.2$; $R = 6 \times 10^6$. Tests, TDT 391, 395.
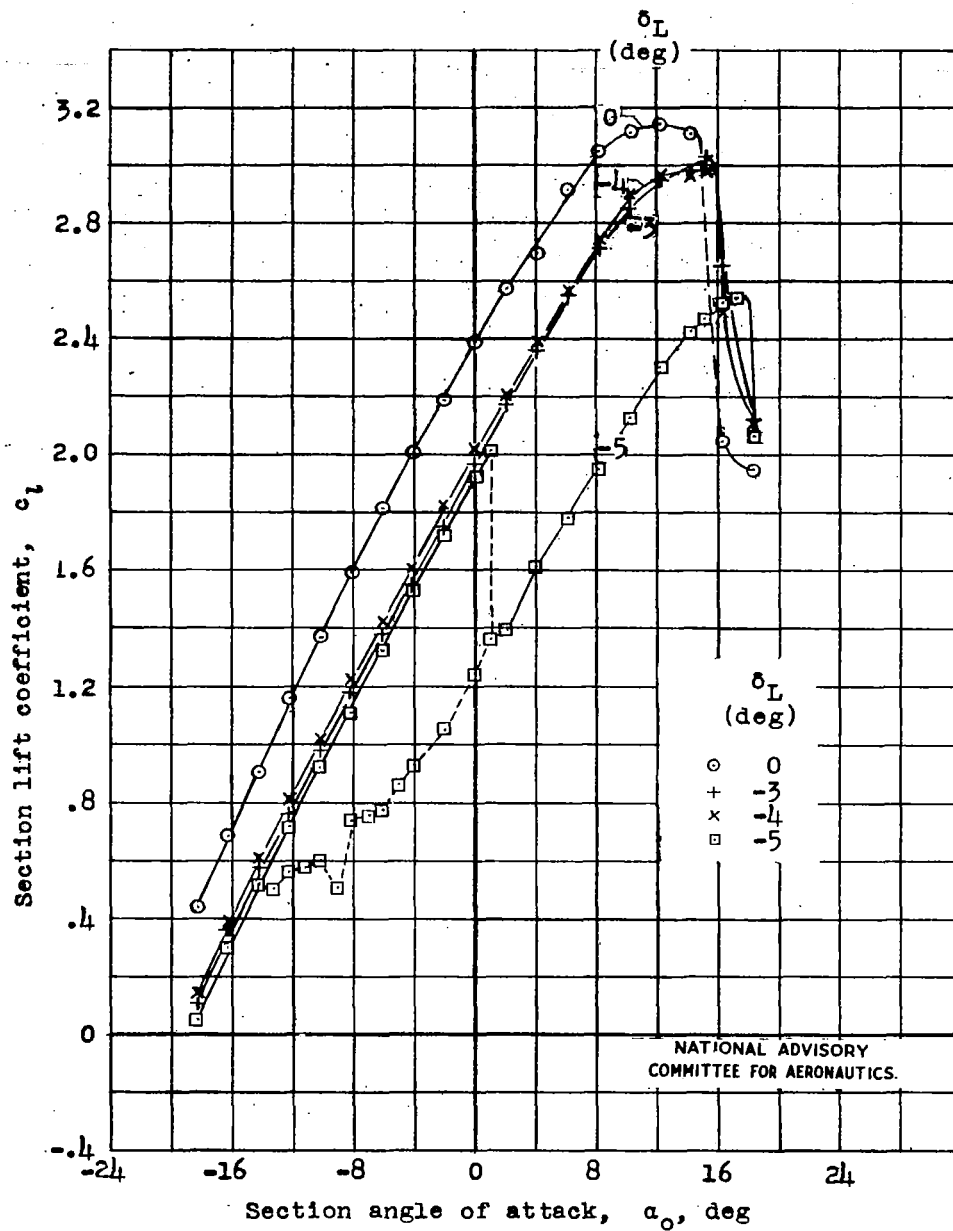
Figure 20.- Flip effectiveness of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_R = 0^\circ$; R = 6 × 10^6. Tests, TDT 391, 393, 395.
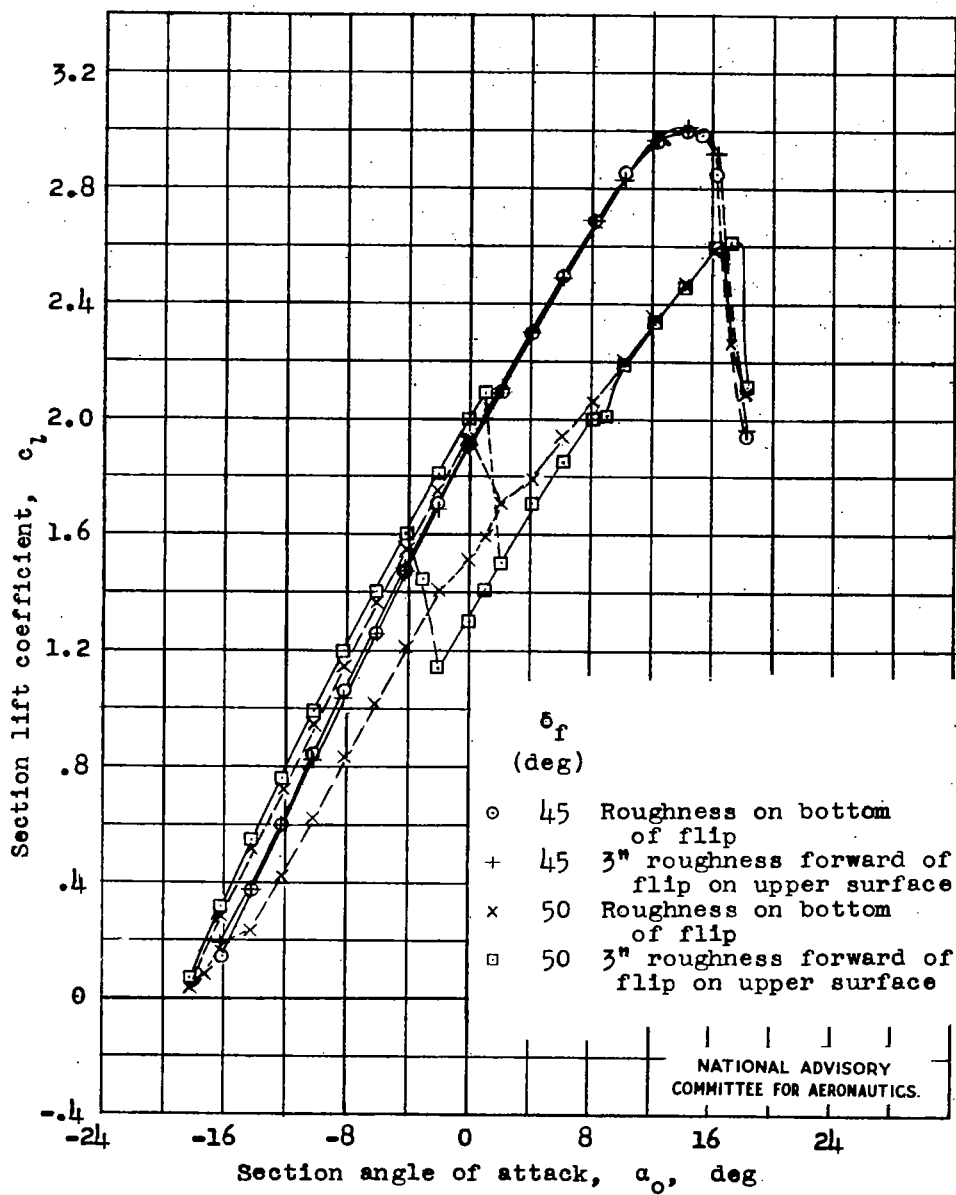
Figure 21.- Lift characteristics of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_f = 45°$; $\delta_R = 0°$; $\delta_L = -5°$; $R = 6 \times 10^6$. Tests, TDT 393 and 395.
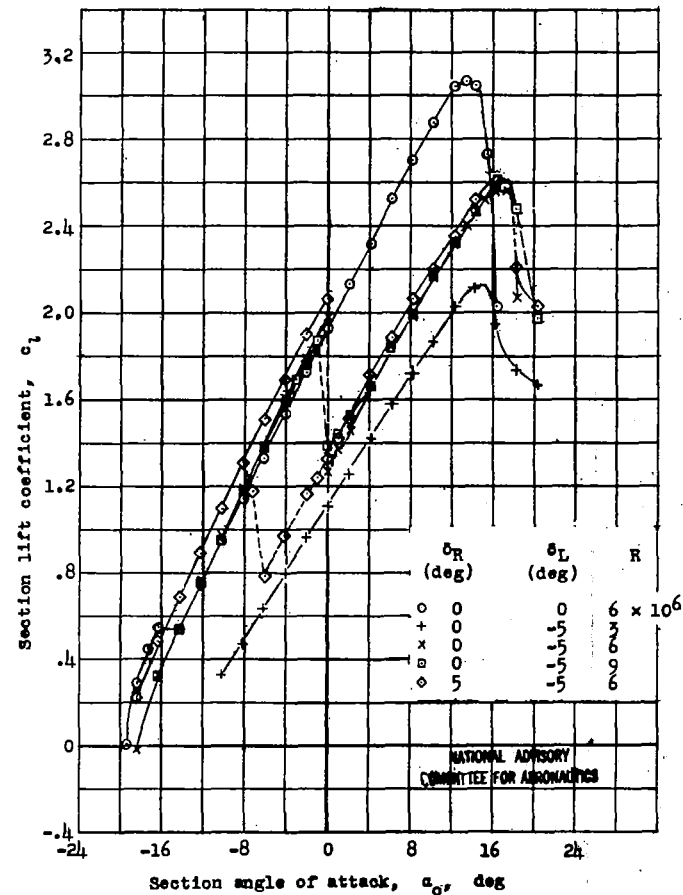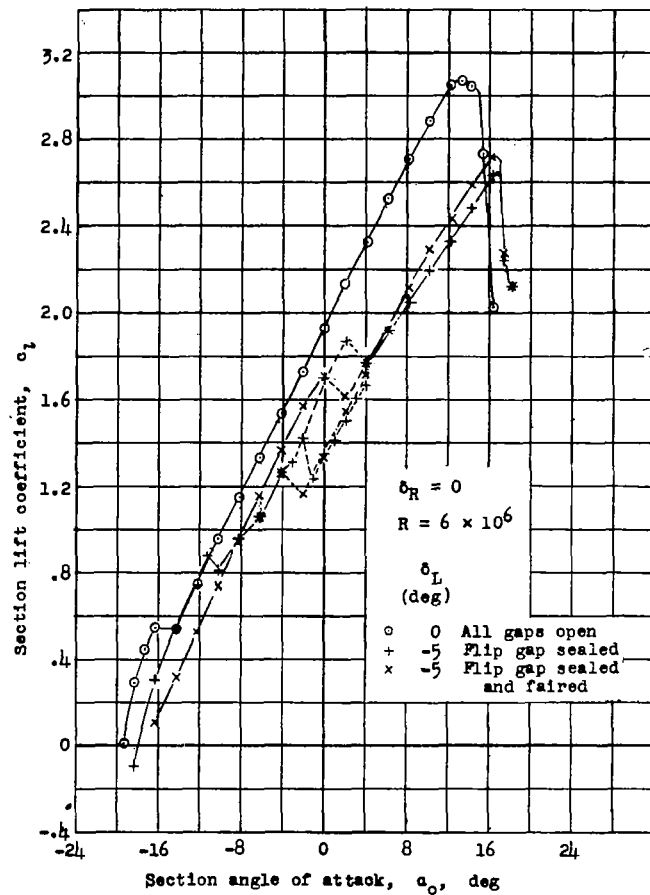
Figure 22.- Lift characteristics of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. Aileron gap sealed, not faired; $\delta_f = 50°$; $\delta_R = 0°$; $R = 6 \times 10^6$. Tests, TDT 391 and 393.
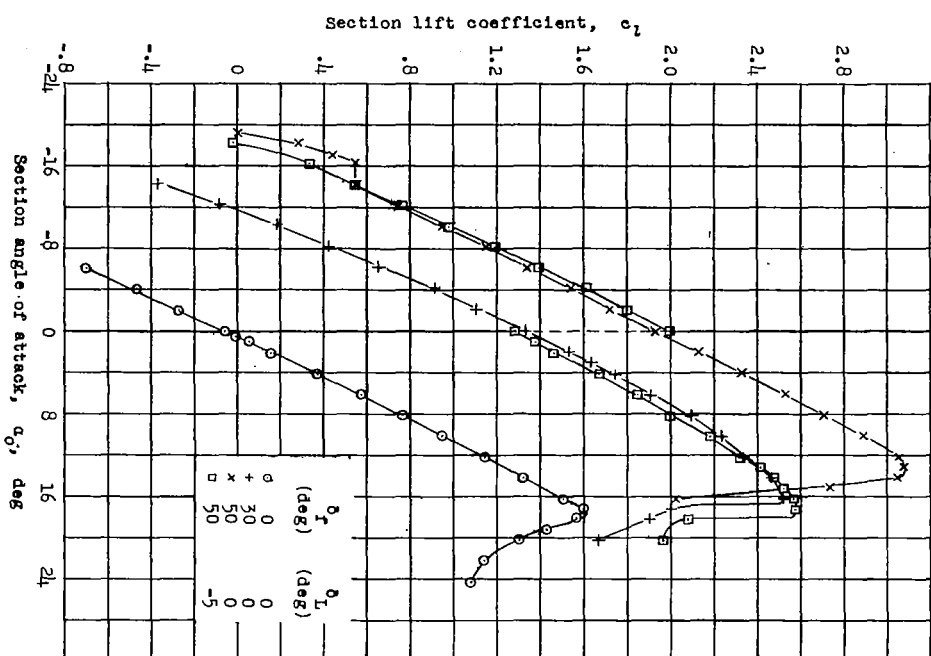
Figure 23.- Lift characteristics of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_R = 0$; $\delta_L = -5°$; $R = 6 \times 10^6$ Test, TDT 393.
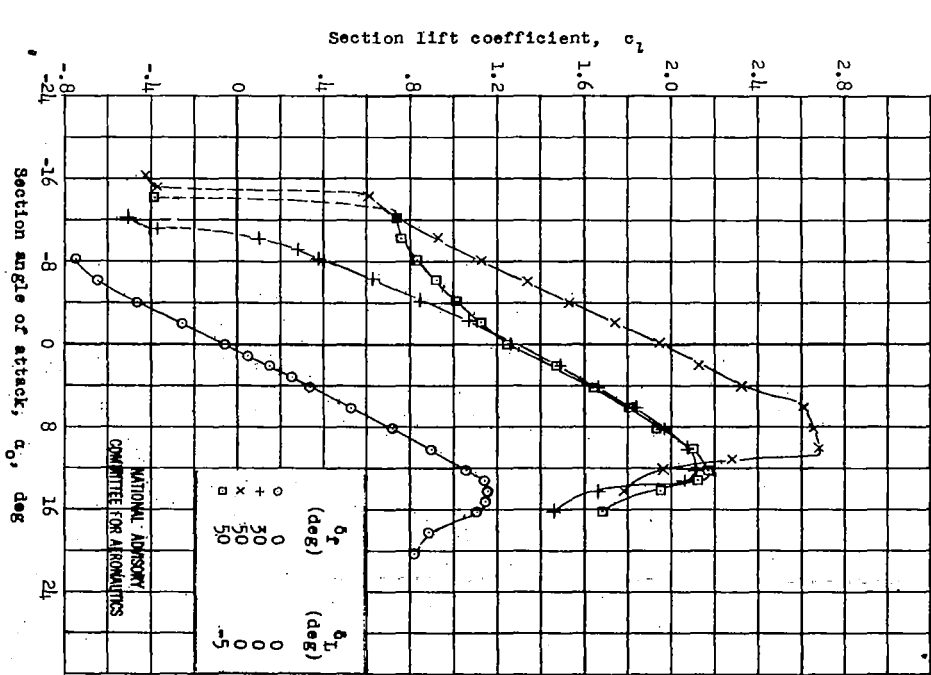
Figure 24.- Lift characteristics of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_f = 50°$. Test, TDT 391.

Figure 25.— Lift characteristics of a Douglas airfoil of NACA 7-series type with double-slotted flap, aileron, and flip, station 950 of C-74 wing. $\delta_R = 0°$; R = 6 × 10⁶. Tests, TDT 391 and 393.

(a) Smooth condition.

(b) Leading edge roughness.